AMENDMENT 2

TO THE

FISHERY MANAGEMENT PLAN

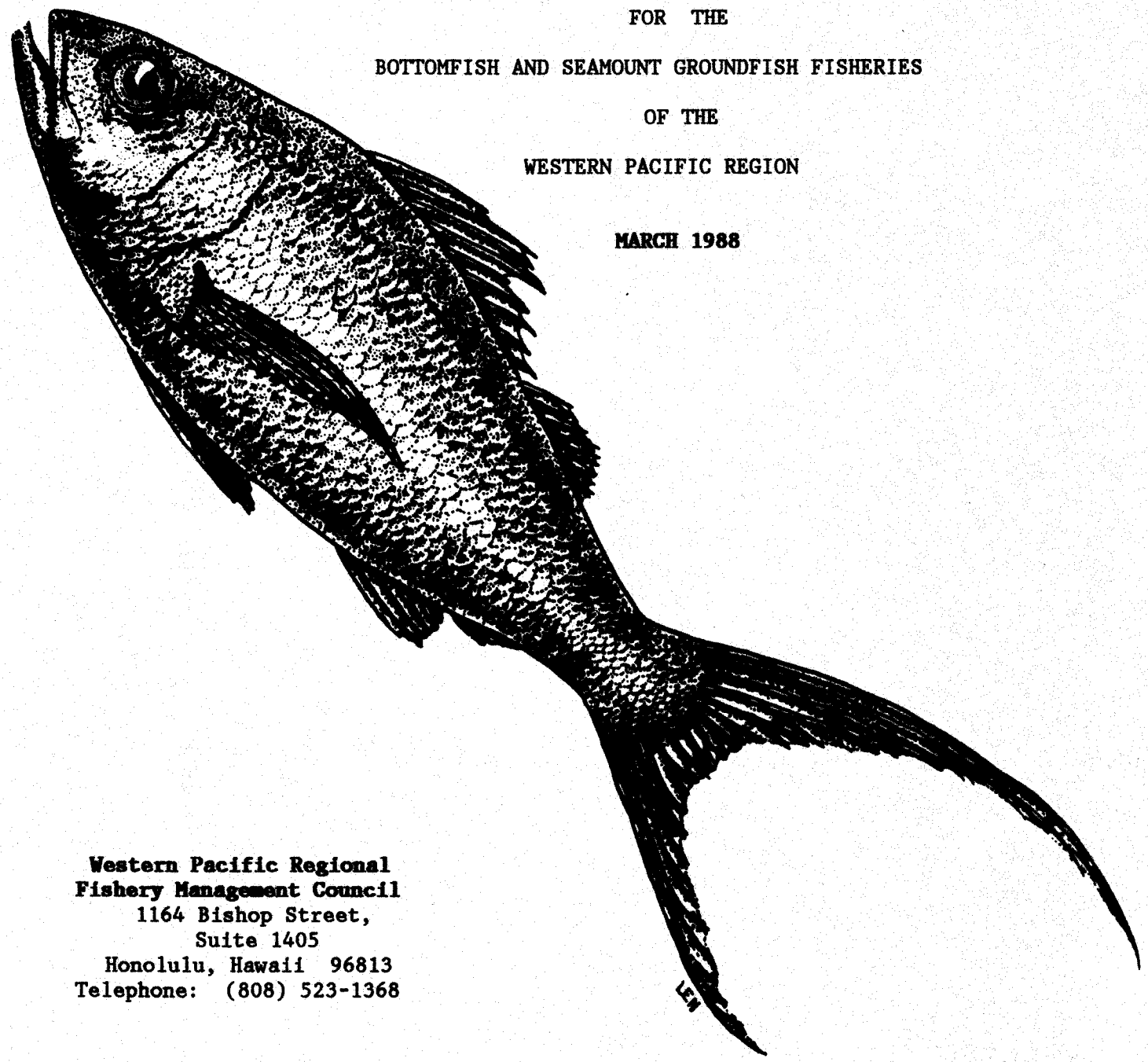
FOR THE

BOTTOMFISH AND SEAMOUNT GROUNDFISH FISHERIES

OF THE

WESTERN PACIFIC REGION

MARCH 1988



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Cover illustration by Leigh Ellis-Neill

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, DC 20235

MAY 9 1988

MEMORANDUM FOR: F/CM - Richard Schaefer

FROM: F/PR - Nancy Foster

SUBJECT: Amendment 2 to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

We have reviewed the subject amendment and feel that the proposed action will have no detrimental effect on protected species of concern to NMFS. We note with interest the requirement for attendance at a seminar on protected species as a prerequisite for obtaining a fishing permit. After the region and council has had experience with this provision, we would appreciate knowing whether this requirement is effective.

We are not as sanguine about the habitat aspects of the Amendment. When we commented on Amendment 1 to the FMP we stated:

> This FMP and Amendment at least marginally meet the new requirements for habitat information and discussions of the habitat alterations on the fishery, but we would like to see a better habitat description and a more specific discussion of habitat recommendations (if any) for the fishery..... The habitat description should also include whatever is known of the habitat requirements of the various species, temperature tolerance, salinity preference for the various stages, etc.

This Amendment, although beneficial to fisheries habitat, did not greatly increase the discussion of the habitat of the species covered by the FMP except for the North West Hawaiian Islands. Although the Amendment only affects the fishery in the NWHI reopening the FMP presented an opportunity to include discussion of the habitat characteristics and problems around the other islands.

cc: F/PR, F/PR1, F/CM2 (Martenson), F/SWR33 (Slawson),
F/SWC1 (Naughton)

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1.0 FORWARD

Presented in this document is Amendment 2 for the Fishery Management Plan (FMP) for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. The bottomfish FMP was effective on August 27, 1986, as documented under Code of the Federal Register (51FR27413, July 31, 1986).

1.1 Purpose of Amendment

This amendment is designed to establish a limited access program for the bottomfish fishery located in the Northwestern Hawaiian Islands (NWHI). In preparation of the amendment, the Western Pacific Regional Fishery Management Council (Council) has complied with the Magnuson Fishery Conservation and Management Act (MFCMA) as amended in 1986 regarding vessel safety and habitat requirement. The sections of this document that refer to vessel safety are presented in Sections 3.10 and 9.10. Those sections referring to the habitat issue are presented in Sections 9.8 and 9.9 of this amendment.

1.2 Responsible Agencies

The Council was established by the MFCMA to develop FMPs and amendments for fisheries in the U.S. Exclusive Economic Zone (EEZ) around Hawaii, the territories (American Samoa, Guam), and possessions of the United States in the Pacific Ocean (Figure 1). After an FMP or an amendment is approved by the Secretary of Commerce, it is implemented by Federal regulations and enforced by the National Marine Fisheries Service (NMFS) and the U.S. Coast Guard in cooperation with state and territorial agencies.

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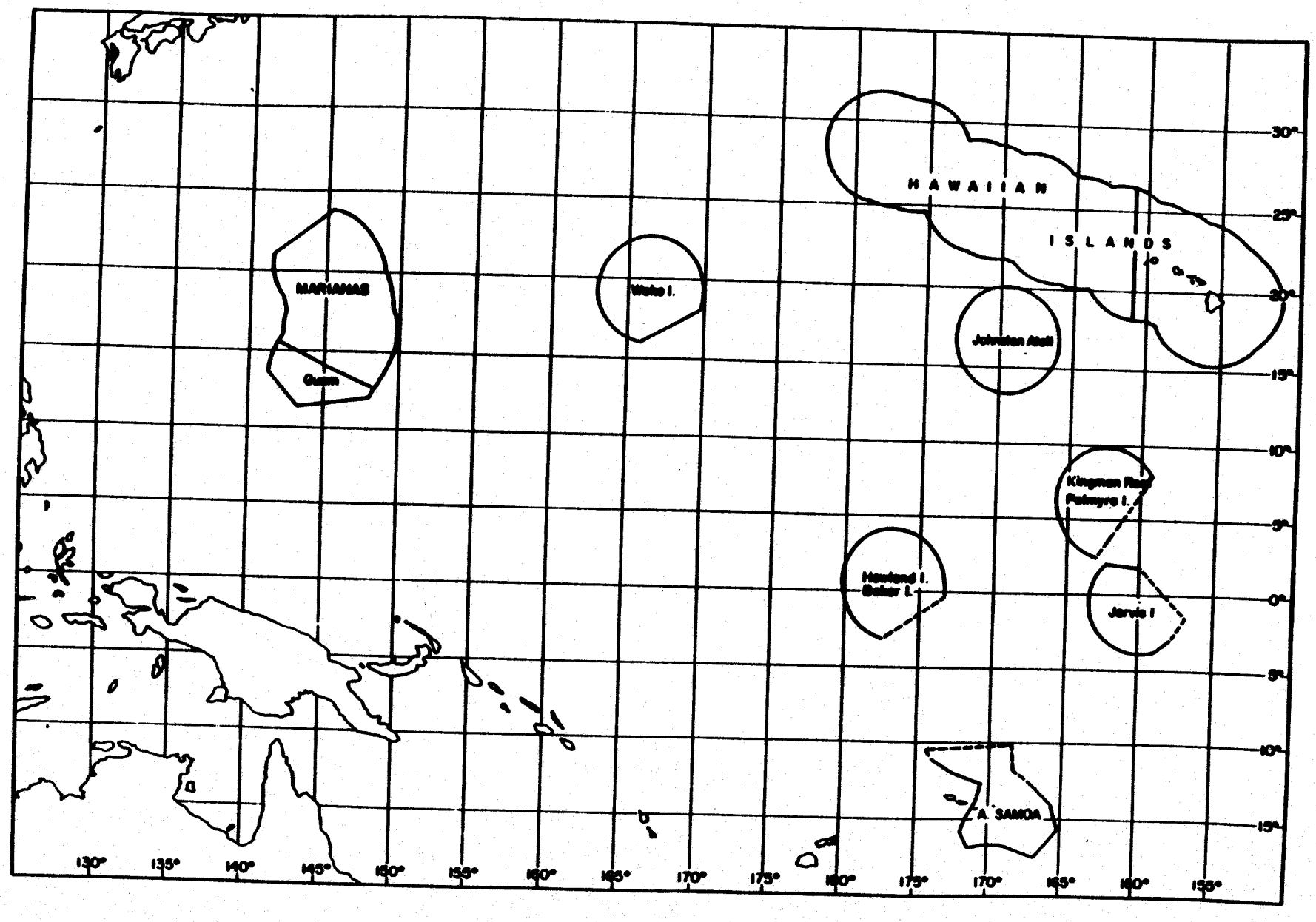


Figure 1. Boundaries of the Exclusive Economic Zone around Hawaii, American Samoa, Guam, the Northern Mariana Islands, and U.S. possessions in the Pacific.

2.0 EXISTING REGULATIONS

The FMP for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region was prepared by the Council principally to establish a framework for managing, within the U.S. EEZ, bottomfish fisheries around Hawaii, American Samoa, and Guam and the seamount groundfish fisheries around the Hancock Seamounts situated at northwestern end of the EEZ of the Hawaiian Archipelago. The FMP became effective on August 27, 1986. The framework FMP prohibits the use of bottom trawl and bottomset nets, explosives, and poisons for harvesting bottomfish, requires a federal permit for fishing for bottomfish in the EEZ of the NWHI, and has established a moratorium on seamount groundfish fishing activities for an initial six-year period beginning on the effective date of the FMP.

Within the framework FMP is an administrative procedure describing the processes by which the fishery will be managed and establishing the limits and controls within which regulatory adjustments may be made. The types of actions that could occur include establishing catch limits, size limits, area/season closures, fishing effort limitations, fishing gear restrictions, permit and/or catch reporting requirements, and access limitation. A set of heavily fished bottomfish species is routinely monitored by a Plan Monitoring Team appointed by the Council, and a set of indicators provides the basis for further investigation or recommendations for action on the part of the Southwest Regional Director, NMFS, through a rule-related notice system.

For the NWHI, the Council is proposing an access limitation program, which is detailed in this amendment. Rather than follow the framework process established in the FMP, the Council chose to submit this management proposal through the regular amendment process because of the potentially controversial nature of the proposal. The Council wanted to ensure a thorough review of the proposal by the general public and all the Federal and State agencies that would be affected by its implementation. As a result, Amendment 2 of the bottomfish FMP will be subject to the 140-day review schedule.

3.0 ELEMENTS OF THE ACCESS LIMITATION PROPOSAL FOR THE NWHI

The idea of using limited access as a management tool to address emerging problems in the NWHI bottomfish fishery first arose in a series of meetings held in 1984 among fishermen, Council members, and scientists. Fishermen and scientists informed the Council that some bottomfish stocks in the southernmost NWHI appeared to be at some risk of overfishing. Fishermen said that the catch rates of the prized bottomfish species *opakapaka* have declined in recent years. Fishermen must either fish deeper for other marketable species of bottomfish or go farther up the chain for *opakapaka*. Fishermen also reported that there were too many boats in the fishery in 1984, and that most boat owners were losing money on an average trip (see Section 6.3.3). The NWHI bottomfish fleet has increased from 5 vessels in 1978 to 29 vessels in 1986 (Table 1). Uncontrollable increase in fishing power could entail significant conservation risks for NWHI bottomfish stocks according to scientists.

The Council, therefore, began designing a program to resolve the situation of an increasing number of vessels entering the fishery for bottomfish in the NWHI, the subsequent fishing down of resources, and the inability of boat owners to make profitable trips. Under the framework FMP, the Council previously explored alternative management measures to prevent overfishing and overcapitalization in fishing effort. These alternatives included catch limits, size limits, individual fishermen quotas, area closures, gear restrictions, landing and trip limits, and access limitation (Section 6.3 of the FMP). Some of these alternatives posed significant problems or high implementation costs, while others were inadequate or required information not yet available. The Council found that only access limitation could be applied with clear long-term benefits to the NWHI bottomfish fishery.

The Council, at its 50th meeting, established August 7, 1985, as the cutoff date for future eligible participation in the NWHI bottomfish fishery. A person that caught any bottomfish in the NWHI, prior to the cutoff date, is considered eligible as a "Grandfather" applicant. According to the Council's announcement of the cutoff date, anyone entering or planning to enter the bottomfish fishery in the NWHI after August 7, 1985, would not be assured future access to the bottomfish resource if a management regime is developed and implemented to limit the number of participants in the fishery. The intended effect of the Council's announcement was to discourage new entry to the fishery while planning continues on whether and how access to the bottomfish resources should be controlled.

The principal elements of the access limitation proposal enumerated below are based on data and analyses contained in "A Briefing Paper Concerning Proposed Regulations to Control Access to the Northwestern Hawaiian Islands Bottomfishery" and "Access Control of the Northwestern Hawaiian Islands Bottomfishery," both developed for the Council by Meyer Resources, Inc. (Meyer, 1987).

3.1 Summary of Access Limitation Proposal

The proposed access limitation program will limit the number of permits to fish in the access control area. The program should diminish the risk of

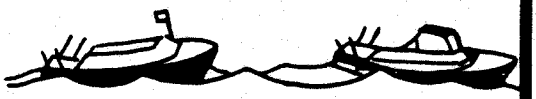
biological overfishing and improve the economic health and stability of the bottomfish fishery in the NWHI. Because this program provides for eligibility based on prior participation, an immediate and drastic reduction in the NWHI fleet is not expected. Rather, the strategy employed in this plan is to 1) immediately stop the influx of new entrants into the NWHI bottomfish fishery, 2) put a cap on catching power of the existing fleet, 3) allow easy exit from the fishery, 4) establish criteria and a procedure to qualify fishermen for future entry into the fishery, and 5) allow free market forces to reduce the fleet through economic attrition to more economically rational levels over several years.

The detailed mechanics of this limited access program are described in the following sections of this chapter. Two complimentary schematic diagrams are available in Figures 2 and 3 to aid the reader in visualizing the process.

The Council will undertake a special review of the effects and effectiveness of the limitation after five years. This evaluation will be done with the assistance and advice of the Scientific and Statistical Committee, the Bottomfish Monitoring Team, and the Advisory Review Board set up by the program. The Council will consider the extent to which the objectives have been met, including the balance between harvesting capacity and the status of stocks, stability in the fishery, and the economic viability of the fishery. The review will provide a basis for considering the need for changes in the program to further progress toward program objectives. The Council emphasizes the importance of establishing and maintaining comprehensive and effective data collection, processing, and reporting programs to ensure the availability of data required for this evaluation.

ELIGIBLE GRANDFATHER APPLICANTS

Owner* of 1 vessel which landed NWHI bottomfish prior to 7 August 1985.



Owner of 2 or more vessels which fished NWHI prior to 7 August 1985. Permits may be received for each vessel which made landings ** of NWHI bottomfish in 1986 and 1987.

Owner presently bottomfishing in the NWHI who served as captain in NWHI fishery prior to 7 August 1985.

Owner who can present proof of intent to own bottomfishing vessel prior to 7 August 1985.

ENTRY OF NEW BOATS

New applicants must own ≥ 25% of a fishing vessel. Selection is based on eligibility points***. These points are received for :

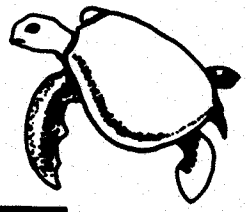
1. ≥ 6,000 lbs landed in MHI
2. ≥ 3 bottomfish landings in NWHI.

Opened when fishery conditions can sustain more vessels

Apply within 5 years

Applications and information are available at the Western Pacific Program Office (NMFS) 2570 Dole Street.

Captains of vessels must attend workshop on endangered species in the NWHI.



Annual review of fishing activities. Required to maintain ≥ 3 landings of NWHI bottomfish annually.

If approved then continue fishing.

If not because of failure to comply then out of NWHI fishery.

If not because of voluntary withdrawal of Grandfather then receive preferential placement **** on waiting list to reenter fishery.

* - See Section 3.5 for specification of vessel ownership.
** - See Section 3.7 for landings definition required for permits
*** - See Section 3.8 for details
**** - See Section 3.11 for details

Figure 2. Ho'omalu Zone permit eligibility criteria.

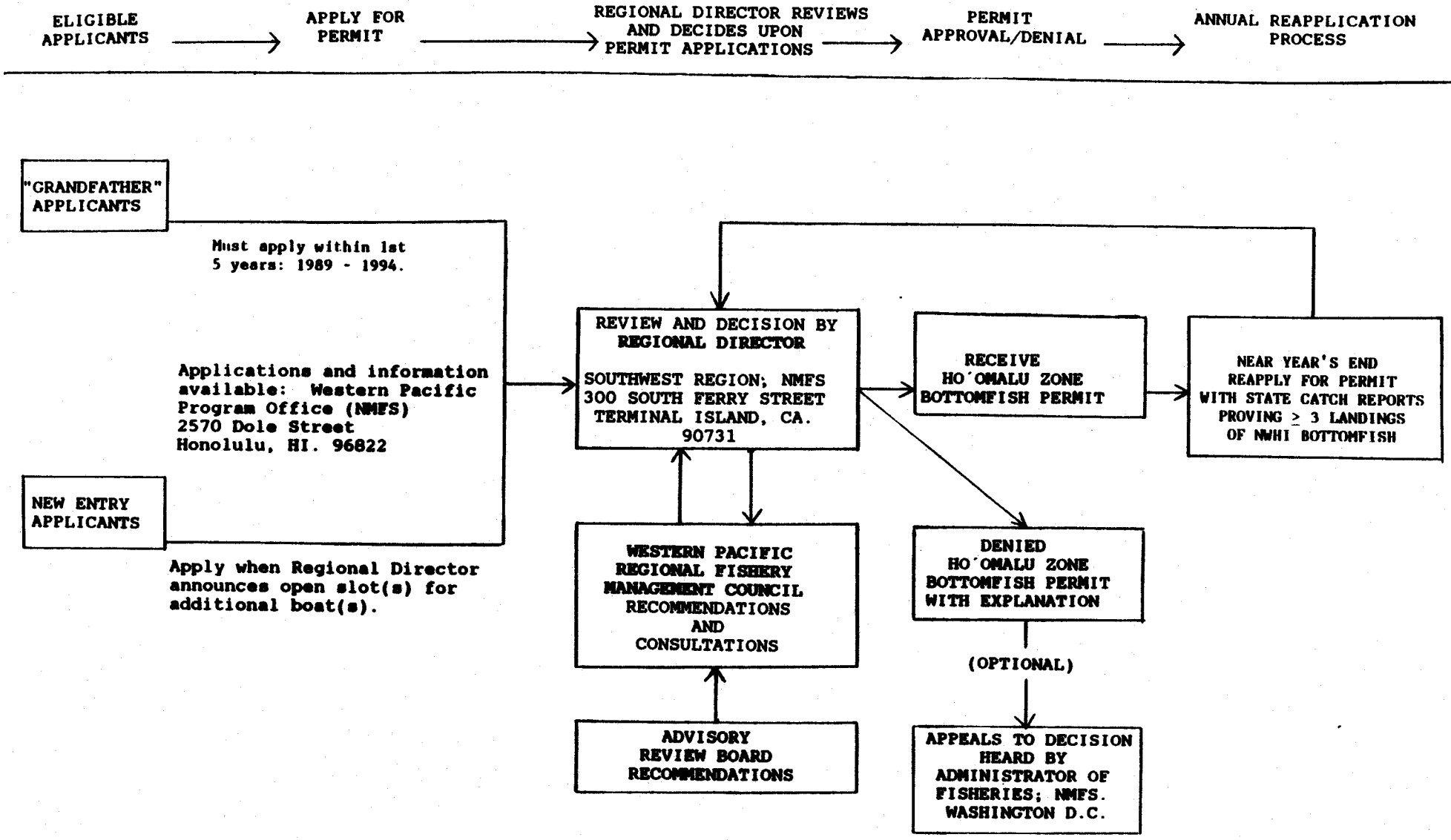


Figure 3. Ho'omalu Zone permit application and renewal process.

3.2 Area of Application

The proposal to control entry into the bottomfish fishery will apply in the U.S. EEZ of the NWHI. Bottomfishing in State waters in the NWHI will remain unaffected. Likewise, the proposal will not affect entry to the bottomfish fishery around the main Hawaiian Islands, either in State or in Federal waters. For the purpose of this amendment, the dividing line between the main Hawaiian Islands and the NWHI is 161°20'W longitude (Figure 4). Federal waters encompass all waters from 3 to 200 nautical miles from the shoreline of each of the Hawaiian islands. The proposed action treats all landings as occurring in the EEZ unless otherwise proven by fishermen.

3.3 Access Zones

The proposal divides Federal waters of the NWHI into two zones: the Ho'omalu Zone and the Mau Zone (Figure 5). Access to the Ho'omalu Zone, an area just west of Necker Island, would be limited. Most of the Honolulu-based bottomfish fleet currently fishes in the Ho'omalu Zone. Conversely, access to the Mau Zone would remain unrestricted, except for excluding vessel owners permitted to bottomfish in the Ho'omalu Zone. The Mau Zone will strike a balance between the creation of a controlled access area (the Ho'omalu Zone) and the need for a number of smaller bottomfishing vessels, principally from Kauai, to retain access to bottomfish in the area between Kauai and Necker Island. The Mau Zone will also serve as an area where fishermen can gain experience bottomfishing in the NWHI thereby enhancing their eligibility for subsequent entry into the Ho'omalu Zone (Section 3.8).

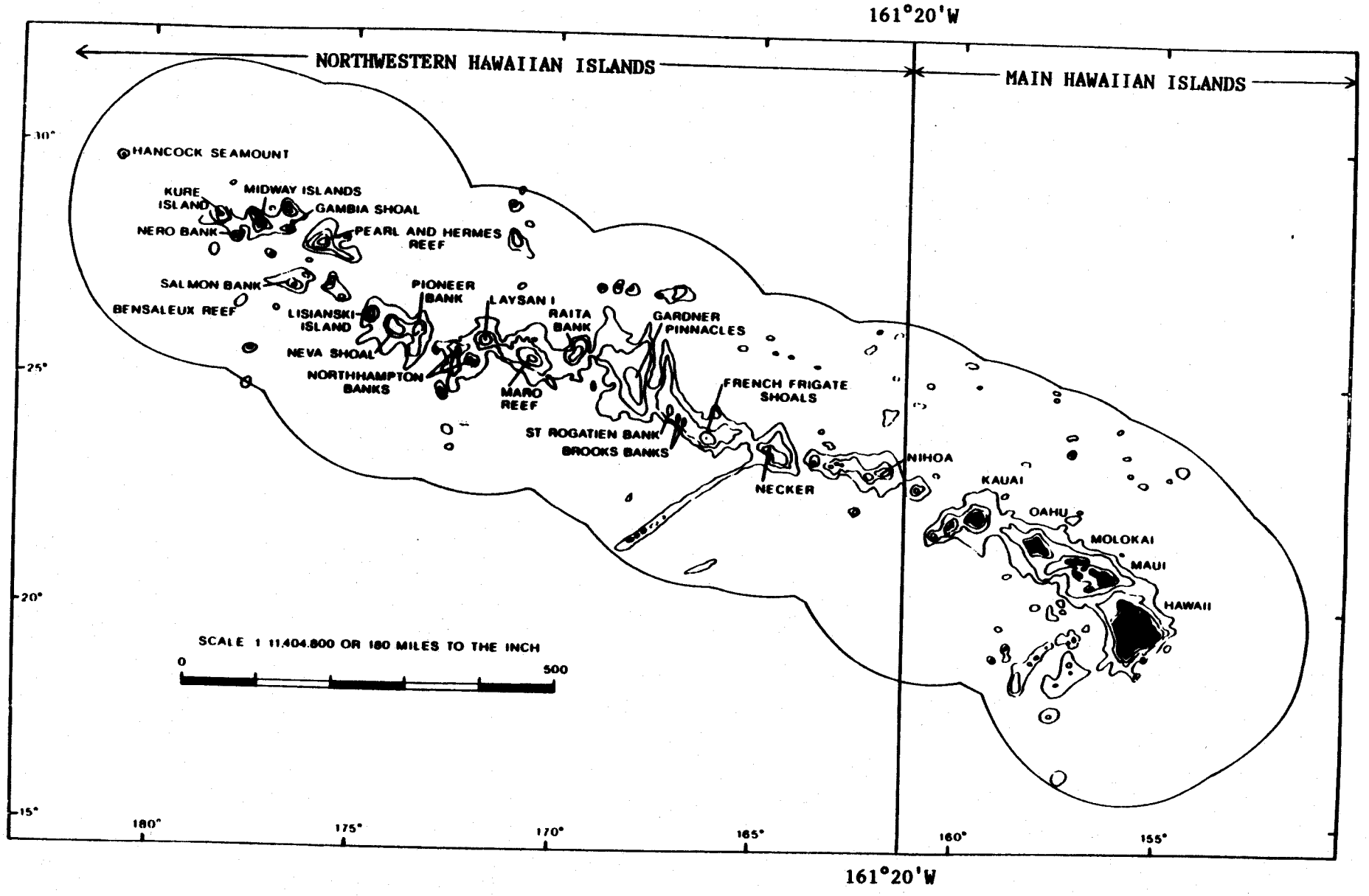


Figure 4 U.S. EEZ around the Hawaiian Archipelago and the dividing line (161°20') separating the main Hawaiian Islands from the Northwestern Hawaiian Islands.

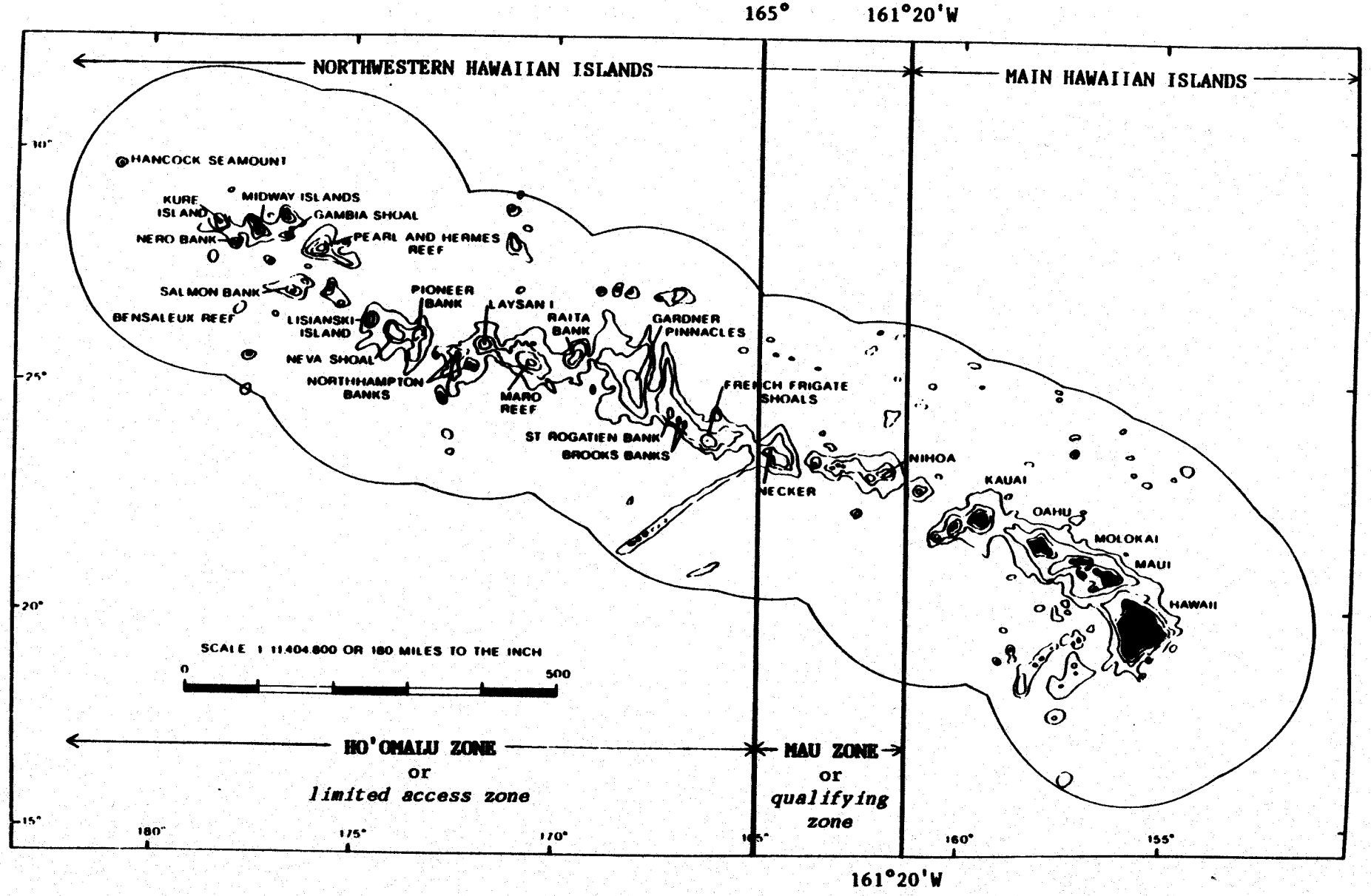


Figure 5 U.S. EEZ of the Northwestern Hawaiian Islands divided into two zones: the Ho'omalu Zone (*limited access zone*) and the Mau Zone (*qualifying zone*).

3.4 Eligibility Criteria for Initial Ho'omalu Zone Permits

- A fishing vessel owner who can document a landing of NWHI bottomfish on that vessel prior to August 7, 1985 (control date), is eligible to receive a Ho'omalu Zone permit. A landing is defined for this purpose as any amount of bottomfish caught in the NWHI and off-loaded for sale purposes. The Council decided to "grandfather" into the fishery all vessel owners who fished their vessels in the NWHI bottomfish fishery prior to August 7, 1985. Once the program is implemented, owners of "grandfathered" vessels have up to five years to apply for an initial permit to fish in the Ho'omalu Zone, so their eligibility is unaffected if they do not fish in the early years of the program. This feature will assist in keeping the size of the fleet down in the initial years.

- An owner of two or more vessels that caught bottomfish in the NWHI prior to the above cutoff date can receive a permit for each such vessel that made at least one landing of NWHI bottomfish in both 1986 and 1987. A landing of NWHI bottomfish is defined for this purpose as catching and off-loading for sale purposes at least 2,500 pounds of bottomfish or at least 2,500 pounds of fish that, by weight, are at least 50% bottomfish. The landing limitation should ensure that all eligible vessels under a single ownership had a reasonable level of participation in the fishery during 1986 and 1987. Allowing landings of bottomfish mixed with other species will permit vessels that occasionally trolled for pelagic species available in the NWHI.

- An owner of two or more vessels used for bottomfishing in the NWHI prior to August 7, 1985, can receive only a single permit to fish in the Ho'omalu Zone if none of these otherwise eligible vessels made landings of NWHI bottomfish in both 1986 and 1987. A landing of NWHI bottomfish is defined for this purpose as catching and off-loading for sale purposes at least 2,500 pounds of bottomfish or at least 2,500 pounds of fish that are, by weight, at least 50% bottomfish. This restriction allows an owner of several grandfathered vessels at least one permit to reenter the NWHI bottomfish fishery.

- Any individual who did not own a vessel prior to August 7, 1985, can receive a permit if the individual served as a captain in the NWHI bottomfish fishery prior to the eligibility cutoff date and owns 50% or more of a vessel operating in the NWHI bottomfish fishery when this amendment is implemented. This provision protects the interests of captains who purchased their NWHI bottomfishing vessels after August 7, 1985.

- Anyone who can provide evidence of incurring substantial financial expenditures, or receiving written approval for a loan, prior to August 7, 1985, for obtaining a vessel for bottomfishing in the NWHI can also qualify for a Ho'omalu Zone permit. Documentary evidence should be in the form of a written loan approval to obtain a vessel for the purpose of fishing in the NWHI bottomfish fishery, a written offer to purchase such a vessel, or documents showing that such a vessel was under construction. This provision protects the rights of persons who made

goodfaith financial commitments before the announced cutoff date to obtain a vessel for NWHI bottomfishing.

- Eligible candidates must apply for the initial Ho'omalu Zone permit within five years of the effective date of this amendment or lose their initial eligibility for a permit. Allowing eligible boat owners this five-year period to apply for an initial permit will assist in keeping the size of the fleet down in the early years of plan implementation, since the owners of eligible vessels can postpone getting their permits for several years if catches are initially poor.

Documentation of qualifying landings of NWHI bottomfish prior to August 7, 1985, and for 1986 and 1987 for the purpose of securing an initial Ho'omalu Zone permit, must be from commercial catch records from the State of Hawaii Department of Land and Natural Resources or catch records from an other state in the United States. This is designed to encourage compliance by fishermen to State catch landing requirements.

3.5 Retention of at Least 50% Ownership Interest

- A permitted owner of a bottomfishing vessel can be an individual, partnership, or corporation. For the purpose of this amendment, an individual, partnership, or corporation may continue as a permitted owner of a bottomfishing vessel in the Ho'omalu Zone as long as the original individual partners/shareholders of record registered on the initial application retain at least 50% ownership in the permitted vessel or its replacement. If the ownership interest of the original permitted parties falls below 50%, the permit shall lapse and be surrendered to the NMFS. The purpose of this section is to prevent the use of corporate or partner ownership structures to pass fishing vessel permits from one group of individuals to another in perpetuity. Transfer of permits by sale of a corporation or partnership would nullify the "non-sale" and "nontransferable" objectives of Section 3.9.

- A non-owner captain who skippered a vessel that landed NWHI bottomfish prior to August 7, 1985, and who subsequently buys into a partnership or corporation possessing a Ho'omalu Zone permit within five years from implementation of this plan, shall have his name added to the list of originally permitted owners. This would give the captain a status equal to that of the original owners.

3.6 Initial Issuance of Permits for the Ho'omalu Zone

Initial permits will be issued to boat owners who qualify under the requirements discussed above. The permit application must identify the vessel to be used in fishing, the owner, the captain, relief captains, and other information that may be required by the Regional Director. Partners who alternate as captain should be indicated. For partnerships or corporations, owners' names and their percentages of ownership must be included. Vessel identification requirements must be met as established by the regulations. A vessel owner must designate on the initial permit application the same vessel used in the NWHI bottomfish fishery or one of similar catching power. This

will prevent switching to a vessel of greater fishing power at the time of issuance of initial permits. A revised permit application form is presented in Appendix B.

3.7 Renewal of Permits for the Ho'omalu Zone

- A vessel owner initially permitted to bottomfish in the Ho'omalu Zone can renew the initial permit annually as long as the permitted vessel(s) makes a minimum of three landings of NWHI bottomfish during the calendar year for which the initial permit was issued and in each calendar year thereafter. If three landings are not made, an appeal may be made to the Regional Director of the NMFS Southwest Region for a waiver of this requirement under standards established by regulation. However, unprofitability of the fishery is not sufficient reason for the NMFS Regional Director to waive the three-landing requirement. This section requires that permittees remain active in the NWHI fishery for bottomfish if they are to retain their permits. The Council had originally proposed a minimum of five landings per year. However, owners of albacore boats and longline vessels presented evidence that a five-landing requirement would be a hardship for them. A three-landing requirement was therefore proposed and adopted by the Council.

A landing of NWHI bottomfish is defined, for the purpose of permit renewal, as catching and off-loading as at least 2,500 pounds of NWHI bottomfish or at least 2,500 pounds of NWHI fish that, by weight, are at least 50% bottomfish. The latter definition allows fishermen to catch other available species in conjunction with their usual bottomfishing operations. Only one landing per fishing trip can be counted toward the three-landing requirement. Splitting large landings into multiple 2,500 pound parts is prohibited.

3.8 Access to the Ho'omalu Zone by New Vessels

- Entry of new boats into the Ho'omalu Zone would take place only when it is shown that the bottomfish stocks could support new entry of boats and that the average catch in the fishery by permitted bottomfishing vessels is sufficient to generate revenues that cover average costs (including a reasonable rate of return or opportunity cost). After consulting with the Council, the Regional Director will determine when new entry can take place, the size and fishing power of the vessel or vessels to be allowed, and the persons to receive permits, by applying the objectives set forth in Section 8.0 and the criteria set forth in this section.

- New applicants must own 25% or more of the vessel they wish to have permitted for the Ho'omalu Zone. The lowered ownership requirement will allow a broader spectrum of boat owners to participate in the NWHI fishery in future years.

- Selection of new entrants will be made from applicants with the most eligibility points. Eligibility points are based on the history of participation in the fishery for bottomfish in the Hawaiian Islands. Applicants must maintain their own files of valid documentation verifying

claims of accrued points. Copies of these documents must accompany all permit applications submitted to the Regional Director.

-- A boat owner or captain will receive one eligibility point for each year with documented landings totaling at least 6,000 pounds of bottomfish caught in the main Hawaiian Islands.

-- A boat owner or captain will receive two eligibility points for each year with three or more documented landings of bottomfish caught in the NWHI (Mau Zone or Ho'omalu Zone). A landing, as used here, is at least 2,500 pounds of bottomfish or at least 2,500 pounds of NWHI fish that are, by weight, at least 50% bottomfish.

-- A boat owner or captain can claim points for either the NWHI or the main Hawaiian Islands' bottomfish fisheries, but not for a combination of these fisheries, in any single year.

-- There is no historical limit for which points may be claimed for previous years of bottomfishing, provided that the weight and location of catches (landings) can be documented.

-- No additional bottomfishing permits would be issued under this section to any owner already permitted to bottomfish in the Ho'omalu Zone.

-- This section provides an approach to future entry that is based on fishing history. It provides a graduated entry opportunity for persons who wish to eventually participate in the Ho'omalu Zone bottomfish fishery.

3.9 Ho'omalu Zone Permits Are Not Transferable or Saleable

o Permits for bottomfishing in the Ho'omalu Zone under this plan cannot be transferred from one boat owner to another and cannot be sold. If a vessel covered by a permit is sold, the permit remains with the original permittee for possible use for a replacement vessel. If the sold vessel is not replaced within 12 months, the permit shall be surrendered. Provisions of Sections 3.7 and 3.10 apply if a permit is retained by the owner. The Council gave serious consideration to including in the plan a transferable permit system. However, experience in the Alaska salmon fishery gave an example where unearned windfall profits can be accrued by "grandfathered" fishermen when it is possible to transfer and sell fishing permits (Karpoff, 1984). The Council considers such profits a fundamental drawback to the system because it allocates the public resource to private individuals for personal gain on an unequitable basis. Under a transferable permit system, fishermen could be guaranteed profits simply by selling their fishing privilege. Under this amendment, grandfathered fishermen must exercise that privilege by fishing in order to realize a profit from the resource. Another potential result of transferable permits is people of lower and middle incomes could find it cost prohibitive to enter the fishery in the future if permit fees became excessive. Such a system could price out of the market those fishermen with nonpecuniary

interest in the bottomfish fishery. The Council chose to establish an access limitation program that will only constrain future entrants based on their experience in bottomfishing locally (point system) not on their economic status.

3.10 Replacement of Permitted Vessels

- An owner of a vessel holding a Ho'omalu Zone permit may upgrade a permitted vessel of less than 60 feet in length to a vessel of no more than 60 feet in length. Discussion with fishermen resulted in selection of 60 feet in length as a "safe" vessel size in general. However, in view of the severe sea conditions sometimes encountered in the NWHI, an exception to this 60-foot cap on replacement vessel length may be possible. Exceptions will be granted from the Regional Director, who will be advised by the Council on such issues. The Council will also advise the Regional Director regarding his determinations of permit holders wishing to replace a permitted vessel with another vessel of equal fishing power, to upgrade to a larger vessel to satisfy vessel safety concerns, or to increase fishing power to maintain fishing power comparability among permit holders' vessels, and to satisfy the objectives set forth in Section 8.0. It is important to have the option available to replace a vessel for the purposes of establishing equal fishing power among boats but may prove to be the rare exception. Fishermen have pointed out that economic constraints associated with crew-share limit the size of their crew and the number of lines they fish. As a result, fishermen indicate the size of the vessel is not necessarily a crucial contribution to the expansion of a vessel's fishing power, and fishery managers need not be overly concerned with the issue.

3.11 Voluntary Withdrawal from the Ho'omalu Zone

- Any permitted owner whose vessel bottomfished in the Ho'omalu Zone and made at least one landing in both 1986 and 1987, may withdraw from the fishery at any time within the first five years of this program and be placed in the first priority category for reentry into the Ho'omalu Zone fishery when the condition of bottomfish stocks and the economic condition of the fleet warrant new entry. Priority for reentry will be based on the chronological order in which departing owners serve notice of withdrawal from the fishery. This "first out, first in" prescription may induce some permittees to leave the Ho'omalu Zone fishery, thus reducing the time period needed to bring the NWHI fishery back to biological and economic viability. Only once is a permit holder allowed to exercise this privilege to withdrawal and then reenter the fishery under this priority scheme. This is to prevent an owner from withdrawing year after year to avoid forfeiting the fishing permit whenever the three-landing requirement has not been met.

3.12 Prohibition of Sale of Incidentally Caught Bottomfish

- Bottomfish caught incidentally in the Ho'omalu Zone by vessels engaged in other fisheries may not be sold, bartered, or traded unless the vessel has a Ho'omalu Zone bottomfish permit. If incidental catches are sold,

bartered, or traded, the vessel involved will be considered to be bottomfishing in the Ho'omalu Zone without a permit, and appropriate penalties will be levied against the offending vessel.

3.13 Workshops on Endangered and Threatened Species Concerns

There are several threatened and endangered species of marine mammals, reptiles, and birds residing in the NWHI (Sections 9.2 and 9.3, bottomfish FMP). The NMFS and the U.S. Fish and Wildlife Service believe that when fishermen are more aware of threatened and endangered species concerns, there will likely be fewer negative interactions between threatened and endangered species and bottomfishing operations. Therefore, captains bottomfishing in either the Ho'omalu Zone or the Mau Zone are required to attend a workshop on the threatened and endangered species in the NWHI. This will be tied to the permit issuance procedure established by the framework FMP. Also, restrictions regarding access to the National Wildlife Refuge in the NWHI will be covered in the workshop.

3.14 Advisory Review Board

- An Advisory Review Board will be appointed by the Council to monitor the workings of this amendment and to advise the Council on needed adjustments to this plan. The Board will receive an annual report on the bottomfish fishery from the Plan Monitoring Team. In addition, the Board will receive input from the Scientific Statistical Committee and the Bottomfish Advisory Panel, and periodic update from the NMFS regarding the conditions of the fishery and bottomfish stocks. Based upon these various sources of information and its own expertise, the Board will recommend to the Council when entry of new vessels into the fishery would be warranted. The Board will also advise the Council regarding replacement of permitted vessels (Section 3.10). The Council will in turn advise the Regional Director concerning new entry into the fishery and vessel replacement. The Board will consist of two fishermen who are permitted to fish in the Ho'omalu Zone, two fishermen who fish in the Mau Zone or the Main Hawaiian Islands, one person who is engaged in fish marketing or processing of NWHI bottomfish, and four technical people--two of which are from the NMFS and two are from the State of Hawaii Division of Aquatic Resources. The technical representatives on the board will include at least one economist and one biologist. The term of nongovernmental members of the Board is limited to five years, and initial terms may be staggered.

3.15 Monitoring

Under the bottomfish FMP, the Plan Monitoring Team is given the responsibility for preparing an annual report. This annual report will be one of the primary sources of management information available to the Advisory Review Board and the Council when evaluating the status of the fishery under the limited access proposal established under this amendment. A supplemental source of information regarding the status of the fleet will include data voluntarily submitted by the fishermen in the form of voluntary logbooks, occasional surveys of subsamples of the fishing fleet (seven or fewer vessels), and periodic reports on the fishery prepared by NMFS. The voluntary logbook is

presently in the developmental stages and should be available for distribution by the end of 1988. An outline of monitoring requirements within the annual report as established under the FMP is presented below.

1. Fishery Performance Data

   a. Total landings (commercial and recreational) by species by area per month.

   b. Estimated ex-vessel revenues by species.

   c. Number of vessels, number of fishing trips, days fished, landings per trip, species composition by landings, areas fished, catch by area, catch per day by area, and other indicators of performance for commercial and recreational fisheries.

2. Summary of Recent Research and Survey Results

3. Habitat Conditions and Recent Alterations

4. Enforcement Activities and Problems

5. Administrative Actions (e.g., data collection and reporting, permits)

6. State and Territory Management Actions

7. Assessment of Need for Council Action

   a. Biological conditions and trends.

   b. Economic conditions and trends.

   c. Social conditions and trends.

   d. Enforcement problems and significance.

   e. Administrative problems.

   f. State/Federal consistency.

8. Recommendations for Council Action

9. Estimated Impacts of Recommended Action

3.16 Permit Duration

Under the FMP, commercial bottomfishing permits for the NWHI are issued by NMFS on a fiscal year basis, thereby establishing their validity from July 1 (or date of issuance) through June 30. This amendment will change the NWHI permit duration period to one based on calender year, January 1 (or date of issuance) through December 31. The amendment also establishes a new permit, the Ho'omalu Zone permit, which will also be good for one calendar year. Thus, the duration periods are consistent between the Ho'omalu Zone permit and the existing NWHI bottomfishing permit which is applicable to those fishermen operating in the Mau Zone for which there is free and unrestricted access. A calender year permit is preferable over a fiscal year permit because it aids in the timely and efficient administration of the program.

3.17 Appeals

Appeals to decisions of the Regional Director shall be heard by the Assistant Administrator of Fisheries, NMFS.

3.18 Postscript

After holding public hearings and meetings on limited entry proposals for the NWHI bottomfish fishery, the Council unanimously voted to accept the principles of this proposal during its 57th meeting on June 4, 1987. The amendment was adopted by the Council for submission to the Secretary for approval and implementation beginning 1989.

The principal motivation for this program is intended to improve the economic health and stability of the NWHI fishery for bottomfish. The Council believes the limited entry program will support conservation and long-term productivity of NWHI bottomfish stocks, but the program in and of itself cannot guarantee the prevention of overfishing. Implementation of this program is viewed by the Council as an important component of the overall management system designed to achieve optimum yield and diminish the risk of overfishing in a cost-effective manner over the long term. If implemented, the program will immediately stop the influx of new entrants into the NWHI bottomfish fishery. It will put a cap on increasing fishing power within the existing fleet and remove impediments to exit from the fishery. It allows free market forces and freedom of choice by eligible fishermen to reduce the fleet to more economically rational levels over several years. It establishes a procedure to qualify fisherman for future entry. Other conservation and management measures may be required in the future to prevent overfishing after this limited entry program is implemented.

4.0 PUBLIC REVIEW AND COMMENT

The Council conducted public hearings and meetings on this amendment:

Date	Time	Location
January 5, 1987	7:00 p.m.	Regional Library Lihue, Kauai
January 6, 1987	7:00 p.m.	McCoy Pavilion Honolulu, Hawaii
February 16, 1987	7:00 p.m.	King Kamehameha Hotel Kailua-Kona, Hawaii
February 17, 1987	7:00 p.m.	Agriculture Extension Service Hilo, Hawaii
February 18, 1987	7:00 p.m.	Maalaea Boat and Fish Club Maalaea, Maui
May 18, 1987	7:00 p.m.	NMFS Kewalo Basin Honolulu, Hawaii

Several changes were made in the access management proposal as a result of the input provided by fishermen and others at public hearings and meetings or in the form of written comments received later: 1) the minimum requirement for renewal of permits for the Ho'omalu Zone was lowered from five to three landings per year, 2) the boundaries of the Mau Zone were adjusted, 3) Ho'omalu Zone permit holders were excluded from fishing in the Mau Zone, and 4) the membership of the Advisory Review Board was expanded to include an extra fisherman from the Mau Zone or from the main Hawaiian Islands.

This proposal is once again being distributed to all fishermen engaged in the commercial fisheries of the NWHI, to fishermen bottomfishing in the main Hawaiian Islands, and to all relevant government agencies and other interested parties. All individuals and organizations are invited to provide written comments on this proposal and on the proposed regulations being published by the NMFS to implement this proposal.

5.0 LIST OF PREPARERS

This amendment was prepared by Justin Rutka, John T. Sproul, and Paul Bartram working as staff with the Council. Svein Fougner, with the NMFS Southwest Region, contributed editorial assistance and ideas to developing sections of this amendment. The data and analyses prepared by Phil Meyer, a consultant hired by the Council to develop an access management program for the NWHI fishery for bottomfish, were summarized for presentation in this document.

The Bottomfish Plan Development and Monitoring Team, composed of the following individuals, reviewed each draft of the access management proposal as it was being developed by Phil Meyer:

Mr. Alvin Katekaru
Marine Section Chief
Division of Aquatic Resources
Hawaii Department of Land and Natural Resources
Chairman of the Team

Dr. George Boehlert
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NMFS - Honolulu Laboratory

Mr. David Hamm, Computer-Systems Analyst
NMFS - Honolulu Laboratory
Dr. Samuel G. Pooley, Industry Economist
Fishery Management Research Program Leader
NMFS - Honolulu Laboratory

Dr. Steve Ralston, Biologist
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Mr. Fritz Amtsberg, Commercial Fisherman
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Mr. Brooks Takenaka, Manager
United Fishing Agency - Honolulu

The Council also acknowledges the contributions made to this amendment by the members of its Scientific and Statistical Committee, especially Dr. James Parrish and the Hawaii members of its Bottomfish Advisory Subpanel. The Chairman of the Subpanel is Fritz Amtsberg.

6.0 NEED FOR ACCESS MANAGEMENT

6.1 Growth and Instability in the Fishery

The proposal to control access into the NWHI bottomfish fishery was developed by the Council at the request of NWHI bottomfish fishermen who believed their economic survival was imperiled by unchecked entry of new vessels. The basis for their concerns is demonstrated by recent developments in the fishery. Only five vessels targeted bottomfish in the NWHI in 1978 and 1979, but by 1986, the fishery had grown to more than two dozen boats (Table 1).

Forty different vessels (A thru NN) have fished for bottomfish in the NWHI during the past 10 years (Table 1). However, only two vessels bottomfished in the NWHI fairly continuously: Vessel C fished eight of the nine years examined and Vessel I fished seven out of the nine years. Table 1 reveals that only 6 vessels bottomfished for five years or more, while 34 vessels (85%) have bottomfished in the NWHI for less than five years during the past decade. Of the 29 boats active in the fishery during 1986, 22 have bottomfished in the NWHI for three years or less, while 7 have fished the NWHI for four or more years.

From the data presented in Table 1, it is evident that the fishery for bottomfish in the NWHI has been characterized by rapid growth, instability, and turnover. New vessels entered the fishery during each year of this period except for 1981. The rate of entry has been substantially greater than the rate of exit. Around 21 currently active vessels would apparently qualify for initial permits under this proposal.

6.2 Pertinent Biological Parameters

Landings of bottomfish in the Honolulu wholesale market were examined for three years (1984-86) to assess the status of bottomfish stocks in the main Hawaiian Islands and the NWHI and the condition of the fishery (Ralston and Kawamoto, 1987). A great preponderance of NWHI bottomfish are first sold through the Honolulu wholesale market, and this market is the most centralized point at which a large volume of landings have been intercepted and data efficiently collected. Because such a large share of the total NWHI bottomfish catch is marketed there, trends and patterns in the landings sold at the Honolulu wholesale market are believed to be indicative of the NWHI bottomfish fishery as a whole. Markets for NWHI bottomfish exist on Maui, Kauai, and Hawaii, but currently they are minor compared to the Honolulu wholesale market.

Results of Ralston and Kawamoto's (1987) assessment of the NWHI bottomfish fishery are presented throughout this section.

Table 1. Entry and exit patterns of vessels that made at least one landing of bottomfish caught in the Northwest Hawaiian Islands, 1978-86.

Vessel Code	1978	1979	1980	1981	1982	1983	1984	1985	1986
A	A	A	A						A
B	B	B	B	B					
C	C	C	C	C	C	C	C		C
D	D	D	D	D	D	D			
E	E								
F		F	F	F					
G			G	G	G	G	G		
H			H	H	H	H			
I			I	I	I	I	I	I	I
J					J	J	J	J	J
K					K	K	K	K	K
L						L	L	L	L
M						M	M	M	M
N						N			
O						O	O	O	
P						P	P	P	P
Q							Q	Q	Q
R							R	R	R
S							S		
T							T		
U							U	U	U
V							V	V	V
W							W	W	W
X							X	X	X
Y							Y	Y	Y
Z							Z	Z	
AA							AA	AA	AA
BB								BB	BB
CC								CC	CC
DD								DD	DD
EE								EE	EE
FF								FF	FF
GG									GG
HH									HH
II									II
JJ									JJ
KK									KK
LL									LL
MM									MM
NN									NN
OO									
PP									
QQ									
Active	5	5	8	7	7	12	20	21	29
Entry	+5	+1	+3	0	+2	+5	+11	+5	+10
Exit	-	-1	0	-1	-2	0	-3	-4	-2
Net ±	-	0	+3	-1	0	+5	+8	+1	+8

Active - the total number of boats that made one or more landings of NWHI Bottomfish for 1978-86.

Entry - the number of "new" boats that did not reenter the fishery from the previous year.

Net ± - the net gain or loss of vessels in the fishery relative to the previous year.

(Source: Meyer. 1987)

6.2.1 Relatively Few Major Species

The principal species of NWHI bottomfish are shown below in Table 2 by their local and common names and ranked by the relative share of each species in landings of NWHI bottomfish in 1986. Although 15 bottomfish species are included in the management unit (FMP 1986, Table 5.1), only 4 species accounted for 95% of the 1986 landings of NWHI bottomfish.

Table 2. Principal species of NWHI bottomfish and their percentages of the 1986 NWHI bottomfish landings.

Local Name	Common English Name	Percent of 1986 Landings of NWHI Bottomfish
Opakapaka	Pink snapper	36.9
Onaga	Longtail snapper	13.3
Hapu'upu'u	Seabass	25.9
Butaguchi	Thick-lipped trevally	19.6
Ehu	Squirrelfish snapper	3.7
Uku	Gray snapper	1.0

(Source: Ralston and Kawamoto, 1987)

6.2.2 Total Landings of NWHI Bottomfish Sold in the Honolulu Wholesale Market

Total landings of NWHI bottomfish sold in the Honolulu wholesale market covering the last three years are shown in Table 3. Within two years, landings of NWHI bottomfish increased by 43%, jumping from 228 metric tons in 1984 to 325 metric tons in 1986. Nearly all landings of NWHI bottomfish are sold as fresh fish. The vessels frequenting the NWHI for bottomfish have the capacity to flood the fresh fish market. To date, an effective market for frozen bottomfish or bottomfish products has not been developed, and this limits the catch per trip as well as the fishing range.

Table 3. Total landings (in metric tons) of NWHI bottomfish made in Honolulu, 1984-86.

Species	1984	1985	1986
Opakapaka	143.4	140.5	119.8
Onaga	3.1	23.4	43.1
Hapu'upu'u	46.1	66.5	84.3
Butaguchi	29.5	56.2	63.5
Ehu	2.2	9.3	11.8
Uku	3.4	0.7	3.0
Total	227.7	296.5	325.5

(Source: Ralston and Kawamoto, 1987)

It is apparent from the data in Table 3 that *opakapaka* has been the mainstay of the bottomfish fishery in the NWHI. However, there has been a marked decline (-16.5%) in the harvest of this species in the NWHI since 1984. *Hapu'upu'u* is the second most important species (in terms of landed weight) in the NWHI deep-sea handline fishery, contributing 25.9% to the 1986 total. The catch of this low-priced species has risen consistently, with catches being 83% larger in 1986 than they were in 1984. Landings of *butaguchi*, another low-priced species, from the NWHI have also shown a steady increase, rising 115% from 1984 to 1986. *Butaguchi* is not one of the preferred bottomfish species because fishermen receive much lower prices for it than for other bottomfish species. *Onaga* is the fourth most important species of bottomfish caught in the NWHI in terms of weight, second only to *opakapaka* in terms of value. The catch of *onaga* has steadily risen from 1984 to 1986, increasing fourteenfold in three years. The catch of *ehu* has risen because *ehu* are caught in association with fishing for *onaga*. *Uku* is a minor species relative to the total landings of NWHI bottomfish, and *uku* catches are expected to stay at low levels.

Several inferences can be drawn from the data presented in Table 3. While catches of *opakapaka* have declined sharply since 1984, *opakapaka* is still the dominant species landed. In direct contrast to the decline in the catch of *opakapaka*, the catch of *onaga* has risen steadily, and NWHI landings of *onaga* have increased fourteenfold in three years. The apparent switch from *opakapaka* to *onaga* (the two most valuable bottomfish species in Hawaii) is likely due to fishermen first targeting *opakapaka* in relatively unexploited fishing grounds in 1984 and 1985, with the *opakapaka* catch demonstrating a largely unfished size structure, and then switching more of their fishing effort to the deeper dwelling *onaga* when *opakapaka* catch rates began to decline.

6.2.3 Current Catches and MSY Estimates

It is important to assess the wholesale market landings of NWHI bottomfish in relation to the current estimate of MSY for NWHI bottomfish. In a memorandum to the members of the Bottomfish Plan Monitoring Team dated 27 March 1986 (Appendix A), Dr. Stephen Ralston summarized information pertaining to estimates of bottomfish productivity (Ralston and Polovina 1982; Polovina and Ralston 1986) and habitat area within the Hawaiian islands. Bottomfish MSY for the primary fishing area in the NWHI (Nihoa to Lisianski Island) was estimated to be 275 metric tons annually. Table 3 shows that, in two of the last three years, the landings of NWHI bottomfish from the same area have exceeded the estimated MSY level, and the amount of bottomfish sold at the Honolulu wholesale market during 1986 substantially exceeded (18%) the projected MSY (Ralston and Kawamoto, 1987).

The fact that the 1986 catch of NWHI bottomfish exceeded the best available estimate of MSY by 18% need not necessarily be cause for alarm, but rather an indication that the fishery is in a state of disequilibrium. The record 1986 harvest is likely due to "fishing-up" largely unexploited or lightly exploited stocks as the fleet moved much farther to the northwest than ever before. Harvest in excess of MSY levels can normally be expected under such conditions. Nevertheless, there is good reason to be concerned about the condition of bottomfish stocks in the NWHI. With fishing pressure increasing

by 30% between 1984 and 1986 and with the number of vessels in the fishery being unstable and unpredictable from year to year (see Table 1), the risk of overfishing NWHI bottomfish stocks increases. With fishing activity so unstable, both estimation and interpretation of biological parameters from catch and effort data are severely compromised, and the risk of biological overfishing of NWHI bottomfish stocks is heightened as a result.

6.2.4 Geographic Patterns of Fishing in the NWHI and Changes in Species Mix in the Catch

Within the NWHI region, only 8% (1984) and 15% (1985) of the bottomfish lots sampled at the Honolulu wholesale market had the specific bank of harvest recorded. In 1986, the situation improved considerably; 64% of all NWHI bottomfish landings were classified to a specific bank or island location. Figures 6 and 7 show how the geographical patterns of fishing for *opakapaka* and for bottomfish in general in the NWHI have shifted in the last three years. Note that in Figures 6 and 7 the fishing locations are listed on the horizontal axes and are arranged in rank order according to the distance up the Hawaiian Archipelago.

The data presented in these figures confirm what fishermen have been saying all along; starting in 1986, fishermen have been traveling much farther up the NWHI chain to catch significant quantities of *opakapaka* and other bottomfish. While in 1984 the expected or average distance to the fishing grounds for a load of *opakapaka* was 498 nautical miles from Honolulu, the comparable figure for 1986 was 771 nautical, miles an increase in average travel distance of nearly 300 nautical miles. It is evident that fishermen are traveling much greater distances up the NWHI chain to encounter the higher catch rates that characterize unexploited fishing grounds. The move of the bottomfishing fleet up the chain has occurred in conjunction with an overall decline in the NWHI harvest of *opakapaka*, the previous mainstay of the fishery (Ralston and Kawamoto, 1987). The "fishing-up" process for *opakapaka* in the NWHI is now likely completed (the vestiges of "virgin" *opakapaka* populations in the NWHI have likely been cropped), and it may be complete for the other major bottomfish species as well in the not too distant future.

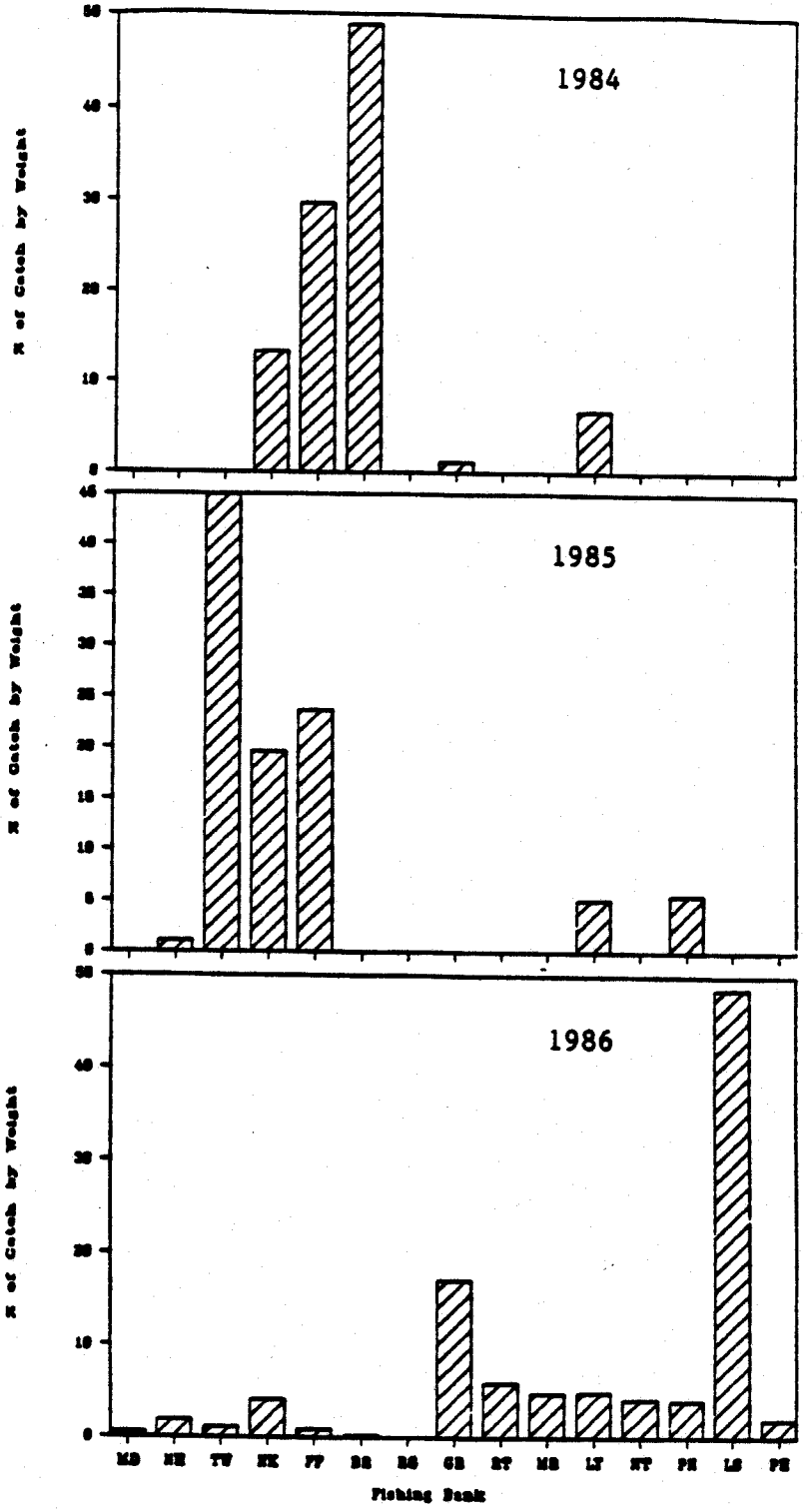

Figure 6. Locations of *opakapaka* harvests in the Northwestern Hawaiian Islands (1984-86). Fishing bank abbreviations are as follows:

MD=Middle Bank
NH=Nihoa
TW=Twin Banks
NK=Necker Island
FF=French Frigate Shoals
Br=Brooks Banks
RG=St. Rogatien Bank
GR=Gardner Pinnacles
RT=Raita Bank
MR=Raro Reef
LY=Laysan Island
NT=Northampton Seamount
PN=Pioneer Bank
LS=Lisianski Island
PH=Pearl and Hermes Reef

Source: (Ralston, S. and K. Kawamoto, March 1987)

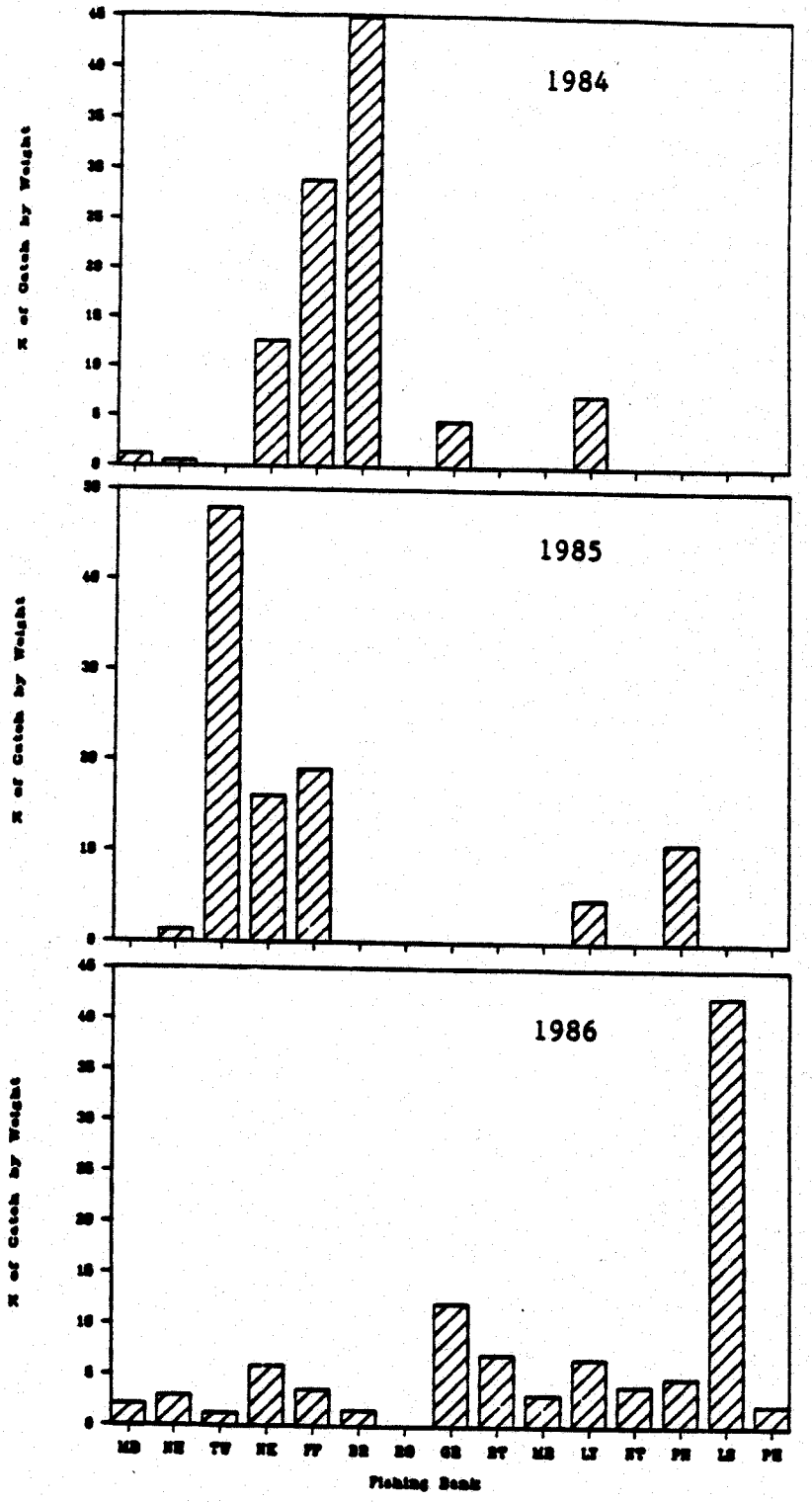

Figure 7. Locations of bottomfish harvests in the Northwestern Hawaiian Islands (1984-86). Fishing bank abbreviations are as follows:

MD=Middle Bank
NH=Nihoa
TW=Twin Banks
NK=Necker Island
FF=French Frigate Shoals
Br=Brooks Banks
RG=St. Rogatien Bank
GR=Gardner Pinnacles
RT=Raita Bank
MR=Raro Reef
LY=Laysan Island
NT=Northampton Seamount
PN=Pioneer Bank
LS=Lisianski Island
PH=Pearl and Hermes Reef

As the fishing pressure in the farther reaches of the NWHI has increased, landings of other less valuable species have risen. The catch of *hapu'upu'u* and *butaguchi* in the NWHI has doubled since 1984 and will further increase, given the extensive fishing activity in the vicinity of Northampton Seamounts and Lisianski Island where these two species are abundant (Ralston and Kawamoto, 1987). As previously indicated, *onaga* is starting to replace the *opakapaka* in the NWHI bottomfish catch. Both are highly priced species; however, further development of the *onaga* fishery in the NWHI has an obstacle. *Onaga* has a shorter shelf life than *opakapaka*. This reduces the length of time that vessels can stay on the grounds fishing for *onaga*.

6.3 Economic Status of the NWHI Bottomfishing Fleet

6.3.1 Value of Total Landings and Average Sales Revenue per Trip

Total landings of the major species of NWHI bottomfish were shown previously in Table 3. In addition to the principal market species of bottomfish, NWHI fishermen also land smaller amounts of less favorable or less abundant NWHI bottomfish. The secondary species of NWHI bottomfish are listed in Table 4 and identified by their local and common names.

Table 4. Secondary market species of NWHI bottomfish.

Local Name	Common English Name
Lehi	Saber jaw jobfish
Gindai	Oblique banded snapper
Kalekale	Snapper
White ulua	Giant trevally
Miscellaneous ulua	Miscellaneous species of trevally (jacks)

Landings of secondary species are compared to landings of major market species of NWHI bottomfish in Table 5 showing each group's share or contribution to total landings. On the average, the major market species accounted for about 90% of total bottomfish landings in 1984-86, while secondary species made up around 10%.

Table 5. Landings (in metric tons) of major and secondary species of NWHI bottomfish, 1984-86.

	1984		1985		1986	
	Metric tons	%	Metric tons	%	Metric tons	%
Major species[a]	227.7	86.2	296.5	89.8	325.5	91.1
Secondary Species[b]	36.7	13.8	34.0	10.2	31.9	8.9
All Species[c]	264.4	100.0	330.5	100.0	357.4	100.0

a) Source: Ralston and Kawamoto, 1987
b) Source: Calculated difference
c) Source: Meyer, 1987

Average annual ex-vessel prices paid per pound for particular species of NWHI bottomfish are in Table 6. The price data are from Pooley and Kawamoto (1988) and are based on data collected by the Council and the NMFS at the Honolulu wholesale market.

Table 6. Average ex-vessel prices per pound for NWHI bottomfish in the Honolulu wholesale market, 1986.

Opakapaka	$3.20	Kalekale	$1.60
Onaga	3.13	Hapu'upu'u	1.56
Gindai	2.95	White ulua	1.07
Lehi	2.30	Butaguchi	0.75
Uku	2.43	Misc. ulua	1.62
Ehu	2.14		

(Source: Pooley and Kawamoto, 1988)

The price data were applied to the total landings of each of these bottomfish species to derive gross revenues received on a fleet-wide basis by NWHI fishermen. Fleet-wide gross revenues are shown in Table 7. Average sales revenues per trip were derived by dividing total gross revenues by the total number of fishing trips taken during each year, 1984-86. Gross revenues for 1984-86 were derived from the prices.

Table 7. Total gross revenue received by the NWHI bottomfish fleet, total number of trips taken, and average sales revenue per trip, 1984-86.

	1984	1985	1986
Total gross revenue	$1,370,000	1,600,000	$1,760,000
Total number of trips	136	159	162
Average sales revenue per trip	$10,100	$10,200	$10,800

The average sales revenue per trip for NWHI bottomfish vessels has stayed relatively stable throughout 1984-86.

6.3.2 Sales Revenue per Trip by Principal Market Species

Table 8 is a compilation of the average sales revenue per trip received for the principal market species of NWHI bottomfish for 1984 through 1986.

Table 8. Species contribution to catch values in the NWHI fishery for bottomfish, 1984-86.

Species	Average Catch Value per Trip			Percent of Average Catch Value per Trip		
	1984	1985	1986	1984	1985	1986
Opakapaka	$7,383	$5,712	$4,849	73.1%	56.0%	44.9%
Onaga	223	1,010	1,879	2.2	9.9	17.4
Hapu'upu'u	1,413	1,683	2,095	14.0	16.5	19.4
Butaguchi	425	673	659	4.2	6.6	6.1
Other bottomfish species	656	1,122	1,318	6.5	11.0	12.2
Total	$10,100	$10,200	$10,800	100.0%	100.0%	100.0%

(Source: Meyer, 1987. Adjusted to reflect 1986 prices.)

The data in Table 8 clearly indicate the rapidly changing source of income to NWHI bottomfish fishermen resulting from catches of different species of bottomfish. In 1984, *opakapaka* provided 73% of the total catch value which averaged $7,400 per fishing trip for bottomfish in the NWHI. By 1986, per-trip sales of *opakapaka* declined sharply to only $4,800, and *opakapaka* accounted for less than 45% of trip sales during this year. Fishermen began targeting *onaga* and, to a lesser extent, *hapu'upu'u* to counter the revenue declines due to reduced catches of *opakapaka*. *Onaga* are now being fished as intensely as *opakapaka* used to be, and *hapu'upu'u* are also being heavily fished. *Onaga* inhabit waters quite a bit deeper than *opakapaka*, so they are more difficult and costly to catch. *Onaga* are probably also less abundant than *opakapaka* because substrate in this depth range is more limited. As

such, *onaga* cannot be expected to be a full substitute species for *opakapaka* in terms of fishermen's income. Since *hapu'upu'u* is worth much less per pound than *opakapaka* (Table 6), this species also cannot be expected to produce sales revenues as high as those for *opakapaka*. The species-by-species patterns in catch values shown in Table 8 generally mirror the patterns in data shown in Table 3. Both sets of data underscore the concerns of fishermen, biologists, and economists who believe that further instability in the fishery will result and that bottomfish will become overfished if the fishery is left unmanaged.

6.3.3 Costs Exceeding Revenues

The instability in the value of the species mix of the catch of NWHI bottomfish (Table 8) and the net annual influx of new vessels into the fishery (Table 1) have had a significant effect on the economic well-being of NWHI bottomfish fishermen. The rapid rise in participation in the NWHI fishery for bottomfish has resulted in a situation where the average vessel in the fleet cannot cover the total annual costs. Widespread economic displacement has resulted. Over 20 vessels have already left the fishery, mostly in the last four years. At the same time, vessels have continued to enter the fishery, negating any resulting benefits to the fishery.

The nature of the market for NWHI bottomfish has, by and large, defined the operations of bottomfish fishermen in the NWHI, and the market greatly influences the income prospects of fishermen. Virtually the entire market for Hawaii bottomfish is for fresh fish. An effective market for frozen NWHI bottomfish products has not been developed, and this limits fishermen's catch of NWHI bottomfish as well as their fishing range. The limiting factors are, first, how long a vessel can stay on NWHI bottomfish grounds and still deliver high-quality fresh fish to Honolulu and, second, the amount of fishing time necessary to land a catch that will meet the vessel owner's financial obligations. When the fishing time needed to make an adequate catch, in terms of the vessel owner's expectations, exceeds the time needed to deliver fresh fish to Honolulu, that fishing activity is no longer profitable. Furthermore, as vessels range farther and farther northwesterly in search of more productive grounds for bottomfish, their trip costs increase and the amount of time a vessel can stay on the fishing grounds and still deliver a fresh product decreases. The NWHI bottomfish fishermen are thus caught in a dilemma--staying out long enough to cover trip expenses, and keeping the fishing trips short enough to deliver a readily saleable, high-quality fresh product.

Table 9 provides estimates of fixed and variable costs for average bottomfishing operations in the NWHI expressed on a per-trip basis. Hau (1984) used 1981 and 1982 data to derive these estimates. The data were collected from three commercial vessels during fishing expeditions for NWHI bottomfish arranged by the State of Hawaii Division of Aquatic Resources.

This economic analysis of full-time NWHI fishing operations was based on the following assumptions: a three-man crew including captain; a diesel-powered vessel of 60+ feet with refrigerator and freezer which cost between $250,000 and $500,000; fishing grounds no more than five days running time from Honolulu; fishing trips averaging 19 days, which includes 10 fishing days; 11 trips per year with 1 month allotted to maintenance and dry-docking.

Table 9. Average costs per trip for a full-time NWHI commercial bottomfishing vessel, 1986.

Cost category/item	Based on 11 trips per year	Based on 7 trips per year
A. Fixed cost		
- Loan payment (principal + interest)	$3,542	$5,566
- Scheduled maintenance and repair	898	1,412
- Unscheduled maintenance and repair	1,833	2,881
- Insurance	2,413	3,791
- Moorage	163	257
Total fixed cost	$8,849	$13,907
B. Variable cost		
- Fuel and oil	$2,274	$2,274
- Bait and ice	647	647
- Food	568	567
- Other	743	743
Total variable cost	$4,232	$4,231
C. Total fixed and variable costs	$13,081	$18,138

(Source: Hau, 1984; data adjusted to reflect 1986 prices.)

The cost estimates of Hau (1984) were based on 1981 prices. Except for costs of insurance, fuel, and oil, cost estimates shown in Table 9 are 21% greater than those reported by Hau (1984) to account for inflation. The cost of insurance has doubled since 1981, while fuel prices have dropped significantly since 1981. Hau (1984) estimated that the average full-time fishing vessel might make 11 fishing trips per year to the NWHI to fish for bottomfish. In 1985, the 21 vessels in the fishery averaged 7 fishing trips each, although some boats only fished part of the season. Costs per trip were thus estimated on a 7 and 11 trips per year basis.

Table 10 combines the 1985 and 1986 gross revenue figures shown in Table 8 with the cost estimates in Table 9. The profit/loss position of owners of NWHI fishing vessels is estimated in Table 10.

Table 10. Average net profit/loss per trip for a full-time NWHI commercial bottomfishing vessel.

	Based on 11 trips/year		Based on 7 trips/year	
Revenue/Cost Item	1985 av.	1986 av.	1985 av.	1986 av.
A. Gross revenue	$10,200	$10,800	$10,200	$10,800
-10% Auction commission	1,020	1,080	1,020	1,080
B. Gross to vessel	9,180	9,720	9,180	9,720
C. Variable costs (Table 9)	4,232	4,232	4,231	4,231
D. Available to skipper/crew	4,948	5,488	4,949	5,489
E. Crew share (40% of D)	1,979	2,195	1,980	2,196
F. Available to owner	2,969	3,293	2,969	3,293
G. Fixed costs (Table 9)	8,849	8,849	13,907	13,907
H. Available to owner after fixed costs	- $5,880	- $5,556	- $10,938	-$10,614
I. Total annual loss	-$64,700	-$61,100	- $75,600	-$74,300

The magnitude of the economic problem faced by vessel owners in the NWHI fishery for bottomfish is clearly revealed in Table 10. Note that the cost figures shown in Tables 9 and 10 do not include vessel depreciation, income paid to the vessel owner, or any other form of opportunity costs. If these figures were included in the tables, the magnitude of the per-trip losses would be higher. These conclusions are, of course, based on averages. A few fishermen are very good or very lucky; they quite consistently show trip profits. Other fishermen on the low end of the learning curve undoubtedly show higher trip losses than the average values shown in Table 10. But the last line in Table 10 underscores the desperation that most NWHI bottomfish fishermen feel. Committed to a way of life but obligated by their boat mortgages and other fixed costs, most fishermen who have established themselves in the NWHI fishery for bottomfish want the Council to restrict the entry of

new vessels in the fishery and thus lessen the problems due to too many vessels chasing too few bottomfish.

Some data on operating costs were also obtained from an albacore tuna troller and tuna longliners which periodically fish for NWHI bottomfish during the off-season of their target species. These vessels benefit from part-time participation in the NWHI fishery for bottomfish because their average catch revenues per trip cover their average variable trip costs, while they cover their capital servicing costs and other fixed costs from income derived from their principal fisheries.

It cannot be assumed that economic failure of vessels in the fishery for bottomfish in the NWHI will rapidly reduce fishing effort to more appropriate levels. Additional destabilization in the full-time fleet of bottomfishing vessels can still be expected. Vessels that can cover variable costs may continue to fish for bottomfish in the NWHI in the short term. Bankrupt vessels are sometimes bought for a fraction of their initial capital cost and could return to the NWHI bottomfish fishery with new owners who believe that much reduced capital servicing obligations will give them a competitive edge over other fishermen. Also, vessels displaced from overfished mainland and Alaskan fisheries have been arriving at a steady rate on a "look-see" basis, their owners and captains being largely unaware of conditions in the fishery when they first arrive in Hawaii.

The result is that established fishermen in the NWHI bottomfish fishery are now looking at a broader range of bottomfish species and a few are exploring at-sea filleting/freezing operations as a way of extending fishing time on distant grounds. Should filleting/freezing become feasible and a market be established for the product, further escalation of fishing power can be expected. This would worsen the condition of NWHI bottomfish stocks since the catch of the NWHI bottomfish has exceeded the estimated MSY level two of the last three years (see Table 3), and the catch of bottomfish sold at the Honolulu wholesale market during 1986 was a substantial 18% higher than the estimated MSY (275 metric tons).

6.4 Criteria for Evaluating Conditions in the Fishery

Section 6.2.1 of the FMP discusses 14 criteria for evaluating problems or conditions in the fishery. Eight of these 14 criteria suggest or demonstrate that problems presently exist in the NWHI bottomfish fishery. Each of the 14 criteria is briefly discussed below:

1. The Mean Size of the Catch of Any Species in Any Area is Pre-Reproductive

Mean size of the catch is a simple indicator of the health of the spawning stocks of particular species. If the mean size of the catch of particular species falls below the first reproductive size, this is an indication of a risk of recruitment failure. An analysis of size structure done by Ralston and Kawamoto (1987) for six major species of NWHI bottomfish demonstrated that very few small fish were landed from the NWHI through 1986 compared to the main Hawaiian Islands, and that the mean sizes of the catch of the species of

NWHI bottomfish studied were larger than the size at first reproduction for those species.

2. Rate of Fishing Mortality to Natural Mortality for Any Species

Suggested as a general lower bound, the spawning stock biomass of a species should not be reduced below 20% of its unexploited level, or a substantial reduction in recruitment will occur (Beddington and Cooke, 1983). Adherence to this guideline would guard against recruitment failure in the bottomfish fishery.

Approximate mortality parameters and sizes at onset of sexual maturity have been estimated for key management unit species of NWHI bottomfish (Ralston and Kawamoto, 1987). Estimates of the natural mortality rate per year, fishing mortality rate per year, weight at entry to the fishery, and age at entry to the fishery are given in Table 11 for the major species of NWHI bottomfish.

Table 11. Mortality rates and weight and age at entry into the fishery for selected species of NWHI bottomfish.

Parameter Estimates	Species				
	Opakapaka	Onaga	Ehu	Hapu'upu'u	Butaguchi
Weight at Entry (kg)					
1984	1.4	4.3	0.6	1.0	2.8
1985	2.6	3.7	0.6	1.1	3.6
1986	2.3	3.8	0.7	1.1	2.1
Age at entry (yrs)					
1984	4.18	7.64	3.09	2.87	-
1985	6.14	6.89	3.09	3.01	-
1986	5.67	7.02	3.36	3.01	-
Fishing mortality (per yr)					
1984	0.61	0.14	0.15	0.00	-
1985	0.37	0.26	0.06	0.00	-
1986	0.28	0.20	0.13	0.00	-
Natural mortality rate (per yr)	0.299	0.274	0.338	0.253	-

(Source: Data from Table 4 in Ralston and Kawamoto, 1987)

The current trend for *opakapaka* appears to indicate a lessening of fishing mortality and an increase in the age at entry during the three years studied. These results are likely due to the extension of fishing into some relatively unexploited grounds in 1985 and 1986 as fishermen have moved farther and

farther up the chain of islands where the catch of *opakapaka* demonstrated a near-virgin size structure.

The fishery for *onaga* in the NWHI is relatively new, as evidenced by the fact that only 3.1 metric tons were landed in 1984 (Table 3). The analysis for NWHI *onaga* indicates a very high age at entry to the fishery (around seven years) and a moderate level of fishing mortality. A change in size structure that would lead to a significant estimate of fishing mortality is not to be expected over such a short time interval. However, the estimates of fishing mortality for *onaga* caught in the NWHI are in need of further evaluation and study (Ralston and Kawamoto, 1987).

A similar analysis was performed on the NWHI stocks of *ehu*. The overall result of the analysis is that improvements to yield of NWHI *ehu* could be realized by increasing the existing level of fishing mortality. The situation with *hapu'upu'u* is apparently the same. The *butaguchi* is a carangid and cannot be analyzed using the methods employed for snappers and groupers regarding derivation of estimates of fishing mortality rate, natural mortality rate, and age at entry into the fishery.

The overall conclusion is that the present ratio of fishing mortality to natural mortality is quite acceptable for all NWHI bottomfish except, perhaps, *opakapaka*. The ratio of fishing mortality to natural mortality appears good for *opakapaka* only because fishermen have been traveling great distances up the chain and fishing relatively unexploited *opakapaka* grounds. The ratio will change once the virgin size structure is fished down.

3. Annual Landings and/or Harvest Capacity of the Existing Fleet Exceed the Best Estimate of MSY

The MSY for bottomfish in the NWHI (for the fresh fish zone--Nihoa to Lisianski Island) was estimated to be 275 metric tons. This MSY estimate is for all bottomfish species combined because it is not yet possible to derive species-specific MSY. As Table 3 indicates, the catch of NWHI bottomfish sold at the wholesale market in Honolulu exceeded the estimated MSY level during 1985 and 1986. Landings in 1986 were a substantial 18% larger than the estimated MSY, probably because, compared to earlier years, bottomfishing trips in 1986 extended much farther up the Hawaii chain. The move up the chain has occurred in conjunction with an overall decline in the harvest of *opakapaka*, the previous mainstay of the fishery. The "fishing-up" process for *opakapaka* is now likely complete in the NWHI, and lower catches and catch rates for *opakapaka* are to be expected in future years. A risk of overfishing NWHI bottomfish species certainly exists.

4. Significant Decline in Bottomfish CPUE from Baseline Levels

A significant decline in catch per unit effort (CPUE) is the most commonly used indicator of deteriorating fishery conditions. For the years 1984-86, 108, 136, and 140 bottomfish fishery trips were made to the NWHI, with landings of at least 1,000 pounds of bottomfish made on each trip. Mean catches of NWHI bottomfish per trip (CPUE) were 4,888 lbs, 5,332 lbs, and 6,539 lbs during 1984, 1985, and 1986, respectively (Ralston and Kawamoto, 1987). From these

aggregate data, there is no indication of a decline in the abundance of bottomfish in the NWHI. Moreover, the mean catch rates of the 11 vessels participating in the NWHI fishery during all three of the years are 4,190 lbs, 4,230 lbs, and 4,866 lbs per bottomfishing trip for 1984-86, respectively. Overall, the total bottomfish catch per NWHI fishing trip since 1984 has not declined. Instead, a slight increase in CPUE apparently has occurred for the NWHI as a whole. However, fishermen in the NWHI have kept moving northwest through the chain of banks and islands to maintain a high CPUE as catch rates decline in the southern reaches of the NWHI. In fact, the decline in catches and catch rate for *opakapaka* in the traditionally fished southern reaches is responsible for the westward "expansion" of bottomfishing vessels in the NWHI, where the distance to the fishing grounds requires a minimum of four to five days of transit time one way from Honolulu.

In 1984, only 15% of NWHI fish lots sampled at the Honolulu wholesale market could be identified to specific bank of harvest. In 1985, bank-specific harvests were recorded for only 8% of the lots. In 1986, the situation vastly improved: 64% of all NWHI bottomfish lots were classified to a specific bank or island location. Despite the marked improvement in the "geography" of the collected catch data for 1986, the small sample size and fairly crude geographical resolution that characterizes the first two years of the collected data precluded detailed CPUE derivation on a bank-by-bank basis. However, the data were sufficient to reach the general conclusion that significant declines in CPUE have occurred for the major bottomfish species in the southern reaches of the NWHI and perhaps even farther northwest.

5. Substantial Decline in Ex-Vessel Revenue Relative to Baseline Levels

Section 6.3.1 (Table 7) indicates that the average ex-vessel value of the catch per trip has stayed relatively constant for NWHI fishermen over the last three years, averaging $10,100, $10,200, and $10,800 during 1984, 1985, and 1986, respectively. However, ex-vessel revenues per trip from *opakapaka,* the mainstay species of the fishery, have declined drastically over the three-year period, with *onaga* temporarily filling the revenue gap as commercial fishermen are forced to go farther and farther up the chain of banks and islands in the NWHI just to maintain their revenue position in search of more productive grounds. On average, an owner of an NWHI fishing vessel for bottomfish has been losing several thousands of dollars per trip (Table 10).

6. A Significant Shift in the Relative Proportion of Gear in Any Area

Vertical hook-and-line gear predominates the NWHI bottomfish fishery. When bottomfish are aggregated, this is an efficient method of harvesting. A significant shift away from vertical hook-and-line fishing to either bottom longline or trap fishing in the future would provide an indication of a change in the fishing mortality. Such a change could indicate a need for management.

A significant geographic shift in bottomfishing in the NWHI occurred in 1986, when bottomfishing activity extended much farther up the NWHI chain than in 1984-85. In 1984-85, the average distance to NWHI fishing grounds was 400-500 nautical miles from Honolulu. In 1986, the average distance to

fishing grounds was almost 800 nautical miles requiring a minimum of four days of transit time just to reach the fishing grounds.

7. Significant Change in the Frozen/Fresh Components of the Bottomfish Catch

Bottomfish fishermen in Hawaii have historically supplied the fresh fish market, and no market has existed for local frozen bottomfish in Hawaii. Because of this, bottomfishing in the NWHI has always been limited to areas within reasonable distance from the fresh market. The distances traveled by fishermen are determined by the shelf life of the targeted species.

There have been a number of initiatives to develop markets for frozen bottomfish in Hawaii, but apparently none has succeeded. At present, there is a rumor that a catcher-processor vessel being built on the mainland may enter the NWHI fishery and fish Lisianski Island and the islands beyond for bottomfish. The fish would be filleted, frozen, and packaged on board.

A shift toward frozen products could stimulate greater fishing pressure on major species throughout their entire range in the NWHI. Since vessels could remain on the fishing grounds longer, they would catch more per trip. If markets for frozen bottomfish products become developed, this would likely result in a large increase in fishing effort for NWHI bottomfish, and a need for a rapid management response would quickly become apparent.

8. Entry/Exit of Fishermen

Entry and exit patterns in a fishery provide an indication of economic and social stability. A highly unstable pattern of entry and exit could indicate that the goal of maintaining a profitable commercial fishery is not being achieved. The pattern of entry and exit of vessels in the NWHI fishery is illustrated in Table 1 (Section 6.1). Over the past 10 years, about 40 vessels have entered the fishery while 11 vessels have left. The fishery is characterized by rapid growth and instability. Except for a single year, the rate of entry to the fishery has exceeded the rate of exit from the fishery. Despite the high rate of failure, new vessels continue to enter the fishery every year. Consequently, the NWHI fishery for bottomfish is unstable, and instability leads to problems.

9. Per-Trip Costs for Bottomfishing Exceed Per-Trip Revenue for a Significant Percentage of Trips

In any fishery, the per-trip revenue must remain above the per-trip costs over the long term for the fishery to remain economically feasible. The rapid rise in participation in the NWHI fishery for bottomfish has resulted in a situation where the average vessel in that fleet cannot cover the costs of fishing in the NWHI. Economic displacement of fishing vessels has already resulted (Section 6.3.3).

10. Significant Decline or Increase in Total Bottomfish Landings

A significant decline or increase in total landings of targeted bottomfish species is a clear indicator of changing fishery conditions. Within two

years, landings of NWHI bottomfish increased by 43%, jumping from 228 metric tons in 1984 to 325 metric tons in 1986 (Table 3). These figures only include the NWHI bottomfish passing through the centralized wholesale fish market in Honolulu. Wholesale bottomfish markets also exist on Kauai, Maui, and Hawaii, but it is not known how much NWHI bottomfish is sold through these markets. It is surely much less than NWHI bottomfish sold through the Honolulu wholesale market.

11. Change in Species Composition of the Bottomfish Catch

A change in the species composition of the bottomfish catch from the initial species mix may be an indicator of a problem of instability. Table 3 (Section 6.2.2) presents the species mix of NWHI bottomfish landings during 1984-86. During this period, the harvest of *opakapaka* declined markedly, and the landings of *onaga, hapu'upu'u, butaguchi*, and *ehu* increased. With fishing effort increasing by 30% in 1984-86, and with the species mix changing so rapidly, there is a growing risk of overfishing NWHI bottomfish stocks.

12. Research Results Indicate Problems

Research results by Ralston and Kawamoto (1987) indicate that the fishery for NWHI bottomfish is presently in a state of disequilibrium. Whether this is a serious problem cannot be established because of inadequate data on fishing at different locations in 1984 and 1985. *Opakapaka* landings are in a state of decline as vessels fish farther up the Hawaiian Archipelago in search of productive fishing grounds. The number of effective vessel trips has increased from 108 to 140 in three years, a 30% increase. As fishing pressure in the farther reaches of the NWHI has increased, landings of *onaga* and less valuable species have risen. Overall landings of bottomfish from the NWHI exceeded the best available estimate of MSY by 18% in 1986. The record 1986 harvest is likely due to the fishing-up of stocks as the fleet moved farther to the northwest and to the record number of fishing trips in 1986. There are good reasons to be concerned about the biological condition of bottomfish stocks in the NWHI with fishing activity so unstable.

13. Habitat Degradation or Environmental Problems

Bottomfish are usually found in habitats characterized by a hard substrate of high structural complexity, thus reducing their accessibility to trawl and longline gear. Habitat degradation or loss is a major concern in a Pacific island bottomfish fishery because of the limited substrate that satisfies bottomfish habitat requirements. Many of the areas where bottomfish reside have been subjected to fairly intensive fishing pressure, only during recent years. While the fishing pressure has been fairly intense, this has probably not had a negative impact on the habitat. The habitat of bottomfish in the NWHI is nearly pristine since it is not subject to any effects of industry or agricultural runoff. It receives very little pollution except for small amounts of trash from fishing vessels and hardware such as leaders, hooks, and weights that are lost after becoming snagged on the bottom.

14. Interactions Between Bottomfishing Operations and Protected Species in the NWHI

There were no reported incidental takes or fishery interactions with protected species by vessels permitted to fish for bottomfish in 1986. However, increased fishing effort in the NWHI could lead to interactions with protected species in future years if nothing is done to control growth in the fishery and improve fishermen's awareness of potential problems.

7.0 ALTERNATIVES AND THEIR IMPACTS

Before choosing the access limitation proposal, which was outlined in Section 3.0, the Council considered many kinds of management actions to institute a response to changing fishing conditions for bottomfish in the NWHI. The alternatives examined by the Council include the following:

7.1 Total Annual Quotas

Quotas would place a ceiling on total annual (or any other period) harvest, and once a quota is reached, no additional fishing would be permitted. Quotas could be applied to one or more bottomfish species or to the entire mixed-species bottomfish complex in the NWHI or subareas of the NWHI. Quotas are normally filled early in a season because they usually encourage a large pulse of competitive fishing as fishermen rush to get a piece of the action. In fisheries managed under quotas, the supply of fresh fish is cut off as soon as the harvest level is reached. This would be very disruptive to Honolulu fresh fish markets because prices would be very erratic, the markets would be vulnerable to import penetration during closed periods, and the existing market for fresh bottomfish might be diminished or even lost forever.

Although quotas can prevent biological overfishing, they would not prevent overcapitalization of the harvest sector. Management by quota usually results in progressively shorter fishing seasons to prevent a growing fleet from exceeding conservation-determined quotas. If quotas were species specific, a major difficulty would be to decide what should be done once a quota was reached for a particular species in a multispecies fishery. Should all further fishing be prohibited, or should some sort of non-retention rule be instituted instead? A quota would result in a waste of fish, which must be discarded even if already dead. To be effectively enforced, a quota system normally requires catch reporting or data collection on catches on a near real-time basis so that fishing will not continue once the quota is reached. This is presently not possible under the administrative procedures of the framework FMP.

The Council rejected establishing total annual quotas as a management tool because the defects of this approach clearly outweigh whatever benefits quotas might provide in preventing biological overfishing.

7.2 Individual Fishermen's Quotas

An alternative method of limiting total catch is to establish an individual fishermen's quota (IFQ) which is a derivative of an overall catch quota. Under an individual quota system, each permitted fisherman would be guaranteed the opportunity to a predetermined percentage of the total quota established annually (or for some other period) for the fishery, regardless of when and where he or she chose to fish. The initial allocation of shares could be limited to fishermen who participated in the fishery in the past or who have already made major sacrifices to enter the fishery.

Each fisherman would either be assigned a share of the catch on the basis of his or her historic catch and the condition of the stocks, or could be

allowed to bid for a share of the catch. Net total share would be set to equal the total overall quota. Annual changes in the total harvest quota could be automatically apportioned among shareholders. The share could be fully transferable; that is, fishermen would be free to buy and sell shares according to their needs. A fisherman could increase his catch by buying more quota shares from other shareholders, reduce his catch by selling some of the shares, or not fish that year and sell all of his quota shares.

Persons lacking a record of historical participation could still participate in the fishery by purchasing unused quotas from shareholders. This would allow new participants in the fishery without increasing the overall catch of the fleet. In effect, IFQs are a marketized, biological quota system. In economic theory, IFQs seem to be a useful and valid fisheries management tool. But the share system poses some very significant problems in implementation, with the most obvious being that of establishing and enforcing species-by-species IFQ or an overall multispecies IFQ for the NWHI bottomfish fishery as a whole. The data base is barely adequate for an estimate of MSY for the bottomfish complex, and species-specific MSY estimates are normally far less reliable. Achieving agreement on MSY levels and apportionment of species-specific shares would be very difficult. Also, assignment of individual quotas would give fishermen a strong incentive to underreport their catch or to misrepresent the species landed, or to land at unpoliced sites so they could continue fishing. Constant, real-time monitoring of ex-vessel sales would be required for an effective share system. At-sea enforcement, including observers or boardings, might be needed to discourage large discards of less valuable species designed to maximize the value of share quotas.

Further, even if transferable quotas are adopted in an IFQ system, the overall reduction in fleet size or fishing power cannot be ensured. Fishing effort may shift among operators, but harvest intensity on bottomfish stocks could remain at unacceptably high levels. Shares would have a strong tendency to shift to fishermen with strong monetary motives and higher incomes. Hawaii's unique cultural setting results in a commercial fishing community with a blend of operators whose interests range from profit maximizers to those seeking a simple lifestyle of the sea. The Council's intent is to optimally manage the regions bottomfish resource with strategies that will retain the integrity of Hawaii's unique social fabric. An IFQ system does not compliment Hawaii's situation because fishermen with strong nonpecuniary objectives associated with fishing lifestyle would likely be displaced. The Council considers these social concerns as "relevant" factors to be considered when managing the fishery to optimum yield as defined by the MFCMA. Based on cost and on social equity grounds, the Council rejected this alternative. Implementation of an IFQ transferable quota system would be very difficult, it would be very costly to administer, and it would be socially disruptive.

7.3 Minimum Size Limits

Minimum size limits could be established for the major species of bottomfish in the NWHI. The minimum sizes would correspond to the size at onset of sexual maturity for the species' females. For some species, the size at onset of sexual maturity is known (e.g., *opakapaka* = 3 pounds; *ehu* = 1 pound), but for other species, the size at onset of sexual maturity is not known at present or may not be an appropriate management measure to use. For

example, minimum size limits are not appropriate to the management of groupers (e.g., *hapu'upu'u*) because the size at onset of sexual maturity varies with population structure.

Many fisheries rely upon minimum size limits as one of several guards against overfishing. The intent of minimum size limits would be to increase the yield per recruit by raising the age of entry into the fishery. An associated benefit could be to augment or protect the spawning stock and subsequent recruitment. A larger spawning population would be expected to increase the size of future year classes, although this outcome may not necessarily occur for several reasons: 1) environmental changes affecting the spawning-recruitment process, 2) changes in egg production, which is independent of the population density, and 3) environmental carrying capacity constraints.

Notwithstanding the apparent benefit of minimum size restrictions, some major problems are associated with their implementation. Deepwater bottomfish usually suffer damage from gas expansion as they are hauled to the surface and have little or no chance of survival if released. Therefore, a minimum size limit for bottomfish should aim to discourage the hooking of undersized fish rather than to require their release. Many fisheries rely upon minimum size limits despite the probable mortality and waste of fish which are dead when caught but cannot legally be retained. A requirement to release undersized fish could encourage relocation of fishing effort away from concentrations of small fish.

However, the Council has rejected the minimum size limits alternative for the time being because there is no evidence of growth-overfishing for any of the five NWHI species of bottomfish analyzed. Although landings of NWHI bottomfish presently exceed the best available estimate of MSY, size structure yield-per-recruit analyses show that NWHI populations of *opakapaka*, *onaga*, *ehu*, *hapu'upu'u*, and *butaguchi* are not growth-overfished (Ralston and Kawamoto, 1987). Relatively speaking, very few small bottomfish are landed from the NWHI compared to the main Hawaiian Islands. This result is likely due to relatively unexploited fishing grounds being targeted in 1985 and 1986, with the catch demonstrating a near-virgin size structure. Establishing minimum size limits for NWHI bottomfish is therefore not warranted, at least not at present.

7.4 Closed Seasons

Seasonal closures usually coincide with spawning seasons to protect spawning aggregations when they are most vulnerable to fishing. Seasonal closures could be applied to reduce fishing pressure on one or more of the major species of bottomfish caught in the U.S. EEZ of the NWHI when the affected species are particularly vulnerable to capture, such as during all or a portion of the spawning season. For species such as *uku*, which are known to form spawning aggregations during a two- to three-month period, seasonal closures could be a very effective means of protecting stocks that are highly vulnerable to capture during spawning. However, the harvest of *uku* from the NWHI is presently negligible (Table 3), and most of the other species of NWHI bottomfish are not known to form spawning aggregations or they spawn over an extended period.

The spawning period for *opakapaka* in the NWHI is from June through December, with peak spawning in August. For *hapu'upu'u*, the spawning period has not been determined; however, ovaries with eggs have been collected from January through April in the NWHI, indicating winter spawning. Very little is known about the reproductive biology of *onaga* in the NWHI, but it is probably similar to that of *ehu* whose spawning season extends from May through October. The spawning season for *butaguchi* in the NWHI has not been determined.

Unless seasonal closures are of great duration, they would not be very effective in protecting the major NWHI bottomfish stocks because they spawn throughout a large portion of the year. Closing a season for one species in a multispecies fishery means either a season closure for all species or waste of the prohibited species which must be discarded. Moreover, a seasonal closure for a particular species covering a broad area to protect spawning stocks would disrupt the pattern of landings and the supply of fresh bottomfish. For example, a seasonal closure on the harvest of NWHI *opakapaka* during its apparent late summer spawning season would cut off the supply of one of the few bottomfish species available to Hawaii consumers during the summer months. Moreover, for year-round operations, many NWHI fishing boats target a combination of species because seasonal availability prevents them from catching enough of any single species. A seasonal closure for any major species could disrupt the pattern of landings.

Seasonal closures are not likely to increase the fish available for harvest in the long term. Fishing effort could increase to exploit the available stock, leading to further and further reductions in the length of open seasons. Moreover, a shortened fishing season would concentrate fishing effort within the season, thereby nullifying any intended conservation gains. Finally, keeping an affected species from the fresh fish market during a closed season could reduce the market acceptance of that species during the fishing season and open the doors for substitutes through imports.

Establishing a closed season or seasons for NWHI bottomfish requires better defining the spawning season for all important species of bottomfish--both in time and in space throughout the 1,200 mile length of the NWHI. At present, stock conservation benefits for the major species of bottomfish in the NWHI cannot be predicted as a result of closed seasons because spawning aggregations, other than for *uku*, have not been documented. In addition, season closures on landings do not preclude hooking and mortality of the species taken incidental to harvests of other species for which the season is open.

7.5 Area Closures

Area closures of the bottomfish fishery in the NWHI could be applied to any of the numerous banks, shoals, and other undersea features intermixed among the islands, atolls, and reefs in the NWHI. Area closures could provide an opportunity to restore the balance to a multispecies fishery. The more aggressive species that are caught first, such as the *hapu'upu'u*, would have an opportunity to recover. Area closures could be applied to a portion of the mixed-species complex in the EEZ. For example, closing a nursery area where

juveniles congregate would protect against premature harvest. Aerial surveillance to detect boats actively fishing (lines in the water) in a closed area is possible, although aerial enforcement capability is limited and costly. Moreover, periodic rotation of closed areas could keep the amount of area available to fishing at more or less constant levels.

The extent to which an area or season closure would protect against overfishing depends on its magnitude and timing. The size of an area could range from two to three miles in diameter to an entire bank. Closures of areas large enough to encompass a significant portion of the home range of the affected species would be more effective, but observations of fishermen and scientists suggest that the extent of the home range is limited for some species (e.g., *onaga, ehu*) and extensive for others (e.g. *uku, ulua*). The growth rates of management unit species suggest that a three- to four-year closure would be needed to protect recruits of severely depleted populations until they grow to spawning size.

Although an area closure may allow depleted stocks to recover, it precludes the possibility of fishing any undepleted stocks in the same area. This would be a detriment to fishermen who target the area for species other than those that the closure is intended to protect. Those fishermen who normally bottomfish in the areas selected for closure are likely to shift to areas or fisheries that are still open. This relocation of fishing pressure may interfere with the opportunities of existing users in the areas and fisheries remaining open. Those who must relocate bottomfishing activities as a result of area closures in the NWHI may incur increased travel times and associated vessel operating costs.

As part of its marine conservation programs, the State of Hawaii has closed, temporarily or permanently, certain reef areas to all fishing. These experiences have amply demonstrated the beneficial effects of area closures in terms of reef fish stock recovery. It is likely that bottomfish populations would respond similarly to area closures. An area closure in the NWHI, in protecting all bottomfish stocks, would serve as a reproductive refuge, enhancing recruitment to nearby areas still open to bottomfishing. However, the benefits of an area closure cannot be assessed quantitatively without at least one experimental closure designed and closely monitored by management agencies and scientists to determine whether bottomfish stocks rebuild and at what rate. The Council has concluded that imposition of area closures without this information would be premature. Until additional information on the possible success of this management option can be collected and evaluated, area closures remain a nonviable option.

7.6 Gear Restrictions

Gear restrictions to reduce fishing power in the hook-and-line fishery could include measures such as limits on the number of lines or hooks, limits on the number of crew members per boat, or restrictions against the use of electronic fish-finding equipment. These measures were considered and rejected by the Council because they could not be enforced effectively at a reasonable cost. Gear restrictions on the hook-and-line fishery would not be an alternative response under the framework FMP. However, the FMP has

prohibited the use of bottom trawl and bottomset nets to harvest bottomfish for reasons given in Section 6.1 of the FMP.

Limiting the number of lines or hooks per vessel would probably be impossible to enforce in the bottomfish fishery. In-port inspections of vessels immediately prior to a fishing trip would not guarantee compliance with such a regulation because each vessel must have spare gear on board to replace any lost during a trip and the "spare" gear could be fished in addition to the legal limit of gear. At-sea enforcement of this regulation would be required because aerial surveillance would not determine the amount of gear a vessel was fishing. Even at-sea enforcement could be ineffective; a fisherman could either discard excessive gear or, if hauling, could cut his gear when approached by a surveillance boat. Even if enforceable, the effectiveness of this approach in reducing fishing effort would be temporary at best because of additional vessels entering the fishery.

Experimental bottomfishing trials with different hook sizes fished simultaneously indicate that small hooks (Nos. 28 and 30) are more effective in capturing small fish (less than 45 cm fork length) than are larger hooks (Nos. 34 and 38) (Ralston, 1982). Thus, fishermen can reduce the capture of small bottomfish by using large hooks. However, even large hooks catch some small fish, so the problem cannot be avoided entirely. Another means for fishermen to reduce the catch of small bottomfish is to shift fishing areas to avoid concentrations of small bottomfish if initial fishing in one area indicates a preponderance of small fish. Still, they will have caught some small fish which cannot be sold or retained. Virtually all fish caught and released will be dead or dying.

The alternative of establishing a minimum hook size was rejected because 1) it is not enforceable other than through at-sea boardings and 2) its effectiveness in conserving stocks is uncertain. Such a regulation would be impossible to enforce through aerial surveillance, would require costly, expanded at-sea enforcement, and could be circumvented through the use of two sets of gear--a legal set for "show" and small hooks for fishing.

Other gear restrictions could be implemented under the framework FMP after sufficient information has been obtained. Restrictions might be placed on the use of traps or other gear. According to fishermen who have experimented with traps in the NWHI, trapping was an efficient method of fishing that, on a large scale, could possibly threaten productive hook-and-line fishing. Hook-and-line fishing relies on the feeding instincts of fish, whereas trapping relies on their curiosity and instinct for shelter. Fishermen believe that schooling behavior of some management unit species (e.g., *ulua*) may account for large trap catches. Traps are an extremely unselective form of fishing gear; they catch almost any bottomfish species able to enter the trap opening. Restrictions on traps could range from a limit on the number of traps per vessel to a requirement for a trap design that reduces ghost fishing. Additional restrictions might be considered if interactions arise between fish traps and protected species in the NWHI.

7.7 Landing Limits per Trip

Bottomfish landings per trip could be limited for the mixed-species complex or for one or more individual species of NWHI bottomfish. This measure would be similar to a "bag limit." The State of Hawaii has set bag limits for several reef fish species but not for deep-sea bottomfish. Because of the different sizes and holding capacities of vessels in the bottomfishing fleet, a single landing limit would discriminate against larger boats. Scaling of limits could be established to match the size structure of the fleet.

Fishermen could circumvent a limit on landings per trip by making more trips. However, limiting the amount of landings per trip, in essence, places a ceiling on the revenue per trip. If fishing costs remain constant or increase with inflation, profitability per trip will be reduced or eliminated, possibly reducing the feasibility of making more trips per year directed at bottomfish. Also, fishing would likely be directed at the more valuable species to maximize revenue per trip within the established time limit. This would put further pressure on *opakapaka* and *onaga* stocks.

The reduction of fishing effort per vessel would not reduce total fishing effort or fishing mortality in the long run if new boats continue to join the fishery. However, the new boats would probably have smaller harvesting capacities; an individual vessel trip poundage limit reduces the economic incentive for greater vessel catching capacity. Limits on landings per trip can be enforced by dockside activities, but enforcement manpower and budgets might have to be increased to cover all of the possible landing sites both day and night. Trip reporting (separate and apart from that presently required by the State) might have to be made mandatory under the Federal permitting procedure. The Council has rejected this alternative because it does not promote the economic viability of the fishery, is costly to enforce effectively, duplicates existing trip requirements, and only minimally contributes to conservation.

7.8 Limit the Number of Trips per Year

An alternative means of restricting fishing effort per vessel is to limit the number of bottomfishing trips per year. Because of the variability in the operations of different commercial sectors of the bottomfishing fleet, the trip limits would be scaled according to fleet structure.

Fishing effort and mortality per boat might be reduced by limiting the number of trips per year, but not if fishermen made longer trips or larger catches (including smaller fish) to compensate for a limited number of trips taken. If frozen bottomfish becomes acceptable to the market, an increase in effort and mortality may occur as a result. In the long run, total fishing effort and fishing mortality would not be reduced if new entrants continued to join the fishery. Trip limits do not require dockside enforcement as extensive as poundage limits per trip, although cross-checking fishermen's trip reports must be thorough enough to discourage cheating. The Council rejected this alternative; it would probably not meet either the conservation or economic objectives of the FMP.

7.9 Crew Limits

Limiting the number of crew members per bottomfishing vessel would certainly serve to reduce fishing power. However, the need to pay each crew member a share of the gross revenue already limits crew size on commercial vessels. Moreover, the fishing power of a vessel is related not so much to the size of the crew as to the skill of the skipper and crew, their knowledge of the topography of the bottomfish grounds, and their fish-finding ability. Vessel clearance immediately before a fishing trip would be required to aid enforcement of such a regulation. However, additional crew members might embark and debark outside of home port. Aerial surveillance would be only partially effective, and sufficient dockside enforcement would be prohibitively expensive. The Council rejected this alternative because it would be ineffective and too costly to enforce.

7.10 Taxation

According to economic theory, fishing effort could be shifted away from overfished species through a landing tax or excise tax that is higher for them than for underfished species. The MFCMA does not authorize the use of taxes as a conservation and management tool. Therefore, the Council rejected this option.

7.11 License Fees

License fees levied upon vessels, gear, or fishermen could limit entry into a fishery, through economic means rather than regulations, simply by pricing the license fees high enough to discourage from participation in the fishery, thereby reducing fishing effort proportionately. Seemingly attractive, license fees offer the potential to generate revenues from the fishery to offset enforcement, monitoring, and research costs. Although an FMP can require a Federal permit or license to harvest management unit species in the U.S. EEZ, the MFCMA limits the permit fee that can be charged domestic fishermen to a level not to exceed the "administrative costs" of issuing the permit. The Council, therefore, rejected this alternative.

7.12 Do Nothing

Doing nothing presupposes either that there is no problem or that a problem is not severe enough to warrant taking any action. In implementing the framework bottomfish FMP, the Council concluded that continued monitoring and investigating potential problems of the fishery must be built into the FMP allowing a framework to make changes as necessary to meet the objectives of the FMP.

Research results by Ralston and Kawamoto (1987) indicate that the NWHI fishery is presently in a state of disequilibrium. Whether this is a serious biological problem cannot be established because of insufficient data on catch and effort at different locations in 1984 and 1985. The number of fishing trips has increased steadily during each year since 1984, and total landings have increased as well. In 1986, overall landings of bottomfish from NWHI exceeded the best available estimate of MSY by 18%. However, the record 1986

harvest is probably due, in part, to fishing-up of stocks as the fleet moved farther to the northwest.

As fishing pressure in the farther reaches of the NWHI has increased, landings of less valuable species have risen. *Hapu'upu'u* and b*utaguchi* have increased regularly (Table 3) during 1984-86, but their lower price makes them only a temporary stopgap against future revenue declines.

The fishing fleet for NWHI bottomfish has had to go farther and farther up the chain of islands to maintain catch values per trip. The average one-way distance from Honolulu to the NWHI fishing grounds is presently around 800 nautical miles. In spite of vast distances traveled and apparent economic losses for the overall fleet, vessels continue to enter the fishery and the number of fishing trips increases. Fishermen must fish harder than ever before to catch an acceptable load, and the prospects for improving this situation are not encouraging. Incentives apparently exist for continued fishery pressure despite an apparently bleak profit picture. Evidence suggests that, on average, sufficient revenue is being obtained by fishermen to cover their variable costs of fishing, but their fixed costs are not being covered. This situation, if left unchecked, will result in greater economic losses to fishermen in the short term and beyond and will lead to reduced fishery yields and further instability. The need for effort control in the fishery is evident.

Doing nothing is not an acceptable alternative because 8 of the 14 monitoring criteria discussed above indicate the existence of problems in the fishery for bottomfish in the NWHI. A status quo alternative would only exacerbate the existing situation and trigger even more problems.

8.0 IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This amendment proposes to establish the access management program for the NWHI bottomfish fishery presented in Section 3. The impacts of various alternatives for regulating fishing effort are compared to the impacts of the proposed access limitation program. The relative effectiveness of the proposed program and three categories of alternative management strategies are evaluated with respect to the following criteria: 1) degree of compliance with national standards for fishery management and conservation established under the MFCMA, 2) ability to achieve the objectives set forth in the bottomfish FMP, and 3) ability to achieve the objectives of this amendment.

Applicable FMP objectives and the National Standards (NS) are listed in this document under Sections 9.2 and 9.7, respectively. The objectives of this amendment are presented below.

Objective 1. To reduce the risk of overfishing on NWHI bottomfish stocks over the long run.

Objective 2. To reduce the level of overcapitalization that presently exists in the fishery.

Objective 3. To increase stability in the NWHI bottomfish fishery.

Objective 4. To increase profitability within the NWHI bottomfish fishery for existing fishermen.

8.1 Categorization of Alternatives

Section 7.0 of this amendment describes the respective impacts of 12 types of effort management measures that were considered by the Council. A comparison of impacts between the proposed action and rejected alternatives is more easily made when the rejected management measures are grouped into two general categories. The no action alternative is considered separately. Grouping of these alternatives generally follows the categorization described in Anderson (1986). The principal categorization criterion is whether these measures encourage economic efficiency or inefficiency in the fishery.

A. Direct Effort Regulation (Limited Entry Policies)

I. Individual quota allocation
II. Taxation
III. License fees

B. Indirect Effort Regulation (Open Access Policies)

I. Total annual quota
II. Minimum size limits
III. Closed season
IV. Closed areas
V. Gear restrictions

VI. Landing limits per year
VII. Trip limit per year
VIII. Crew limits

C. No Action

8.2 Analytical Approach and Constraints

Impacts of management alternatives are assessed under four major headings. Below each heading are specific topics of concern indicated by the MFCMA NS, the bottomfish FMP, or both.

A. Biological and Physical Impacts

I. Bottomfish stock(s)
II. Bottomfish habitat
III. Endangered and threatened species
IV. Other fish stocks

B. Economic Impacts

I. Fishery overcapitalization
II. Bottomfish market stability
III. Harvesting sector stability
IV. Profit maximizing fishermen

C. Social Impacts

I. NWHI bottomfish fishermen
II. Future access to NWHI bottomfish fishery
III. Stability in NWHI bottomfish fishery
IV. Flexibility for fishermen

D. Enforcement and Administrative Impacts

I. Legality under MFCMA
II. Absence of illegal discrimination
III. Minimization of necessary regulation
IV. Minimization of necessary enforcement costs
V. Minimization of administrative costs

As required by NS 2, this amendment is based upon the best scientific information available. However, limiting factors presently existing preclude quantitative analysis on persons potentially eligible under the preferred alternative. Therefore, it is not possible to describe potential impacts of management alternatives on specific sectors of the community. Finally, the impact analysis is limited to generalizing about industry response to management policy. It does not attempt to the predict behavior of individual fishermen.

8.3 Biological and Physical Impacts of Alternatives Examined

A. Impact of Proposed Action

I. Bottomfish stock(s)

The limited access alternative supports protecting the NWHI bottomfish stocks from overfishing (NS 1). This is accomplished by establishing a mechanism to cap the fleet's total catching power and, over time, reducing fishing effort by facilitating the exit of marginally productive and unproductive vessels. New and returning participants in the fishery are regulated by the Council with the assistance of a Council-appointed Advisory Review Board. Fishing effort is managed by constraining fleet size in an attempt to achieve optimum yield over time. Participants will have greater confidence in their personal decisions to fish bottomfish stocks conservatively. Prudence is less likely to be negated by competing fishermen who only have a short-term interest in the fishery. Short-term participation is discouraged under this amendment. Bottomfish stocks have greater protection against overfishing in a fishery composed of operators all having an investment in the long-term productivity of the resource.

II. Bottomfish habitat

The proposed action achieves FMP objective 4, which is directed toward protecting bottomfish habitat from environmentally destructive fishing activities (Section 9.9). Fishermen bottomfishing in the NWHI will have an increased incentive to protect bottomfish habitat since they will benefit directly in the form of healthy sustainable catch rates.

III. Endangered and threatened species

The amendment gives special consideration to threatened and endangered species of the NWHI. Under the preferred alternative, all participants in the bottomfish fishery are required to attend an information workshop on such wildlife. Individuals' valuation of endangered species is significantly influenced by the information they receive concerning an animal's physical and behavioral characteristics and its endangered status (Samples et al., 1986). Information workshops help fishermen in appreciating the importance of these animals and encourage caution by the fishermen.

The NMFS has designated critical habitat for the Hawaiian monk seal in parts of the NWHI. This amendment will not cause, or result in, modification of that habitat and may have long-term benefits. Reduced bottomfishing effort would lower the potential for vessel groundings or other accidents, and the endangered species workshop would ensure that vessel owners and operators are aware of possible problems that might occur if care is not taken.

IV. Other fish stocks

The proposed action indirectly stabilizes and protects other local fisheries and their stocks by discouraging the bottomfishing sector

of Hawaii's fishing community from redistributing its fishing effort. An objective of this amendment is to provide stability in the local fisheries. This amendment will stabilize the NWHI bottomfishery by maintaining substantial sustainable landings, thereby encouraging operator longevity. Stability in this industry should indirectly protect other fish stocks in the NWHI as it reduces fishing pressure that otherwise may be applied by fishermen exiting the fishery. For example, the NWHI lobster fishery is an alternative opportunity for fishermen and presently employs some former bottomfish fishermen. Already the lobster fishery suffers excessive effort beyond that necessary to most efficiently harvest optimal yield (Samples and Sproul, 1987).

B. Impact of Rejected Alternative Categories

1. Establish a different direct effort regulation policy for the NWHI bottomfish fishery

I. Bottomfish stock(s)

Direct effort regulations (Section 8.1.A) would be expected to have positive biological impacts, which are important to the NWHI bottomfish fishery in both the short and long run. These limited entry schemes constrain fishing pressure by regulating the individual firm through the establishment of biological limits (individual quotas) or economic constraints (taxes or fees). Each approach creates conditions conducive to an industry with participants having vested interest in the long-term health of the industry.

II. Bottomfish habitat

As in the preferred alternative, stability in the fishery is created from these policies by the presence of "permanent" fishermen concerned with protecting the future of the bottomfish resource and its habitat. However, the proposed action is considered by the Council to be more attractive because of the difficulties with legally enforcing a tax, fee, or individual quota scheme under the constraints of the MFCMA (see Section 8.6.B.1.I).

III. Endangered and threatened species

Any proposal that reduces the human interaction with endangered and threatened species of the NWHI will prove beneficial to these animals. A central objective of the alternative direct effort regulation policy is the reduction in the number of active fishing vessels. To this end, these policies could benefit endangered species. However, the proposed action is also designed to reduce the number of vessels in the fleet and has an the added feature of requiring fishermen to participate in an information workshop on the endangered wildlife of the NWHI. For this reason, the Council considered the proposed action preferable when evaluated for its potential impact on these animals.

IV. Other fish stocks

Direct effort regulation schemes such as taxes, licenses, and IFQs generally facilitate a fishery's becoming increasingly composed of capital intensive vessels. Such vessels tend to be more efficient in harvesting catch, thereby increasing operational profitability. This is especially important when an entrance fee such as taxes or licenses are imposed. Such policies could encourage the presence of these boats and the potential displacement of existing bottomfishing operations. Displaced vessels would likely shift to alternative local fisheries, creating a net increase in fishing pressure on other fish stocks in the region.

2. Establish an indirect effort regulation policy for the NWHI bottomfish fishery

I. Bottomfish stock(s)

In general, indirect effort regulation policies are designed with the objective of biological conservation and could be implemented to prevent overfishing of bottomfish stock(s) (NS 1). A drawback of open access policies is that they do not encourage the long-term concerns for bottomfish stocks among operators. Performance is on the basis of immediate gains; the fish one individual does not harvest will likely be taken by another individual. Under an indirect effort regulation approach, potentially unlimited numbers of fishermen would be pursuing a limited bottomfish resource. Without individual motivation to fish conservatively, the future productivity of the resource is at risk. An additional disadvantage of this approach is its creation of inefficiencies in the fishery. The promotion of inefficiencies conflicts directly with NS 5, a crucial factor for their rejection as a management approach for the NWHI bottomfish fishery.

II. Bottomfish habitat

Indirect effort regulations discourage conservative operations that otherwise would have more concern for bottomfish habitat (FMP objective 8). Under this policy approach, fishermen tend to be more interested in short-term gains than in the long-term biological impacts stemming from their fishing practices. Such shortsightedness would increase the potential for habitat degradation and a lack of concern for the future condition of the environment.

III. Endangered and threatened species

These policies could increase the number of interactions between fishermen and wildlife and negatively impact endangered and threatened species. Under indirect effort regulations, additional vessels can continue to enter the fishery, exposing the environment to increasing amounts of fishing gear and raising the risk of animal entanglement. Unlike the proposed action, nothing is designed into these management schemes to discourage short-term participation in the fishery. And following the argument presented above, shortsightedness and a general disregard for the future of the resource could

manifest themselves in terms of increased debris and its associated negative impact on habitat and marine life.

IV. Other fish stocks

Indirect effort regulations have the potential to inadvertently increase fishing pressure on other fish stocks in the Hawaiian Archipelago because they do not inhibit the influx of new boats. As a result, the potential exists for a growing number of commercial fishing vessels in the area. Some of these boats entering the NWHI bottomfish fishery may shift to exploit other local fisheries. If these boats come from outside the existing pool of Hawaii-based fishing boats, a net increase in fishing power will occur in the Hawaiian Islands and may be utilized in fisheries that are presently overexploited.

3. No action

I. Bottomfish stock(s)

The no action alternative negatively affects bottomfish stocks of the NWHI and directly conflicts with the objective to prevent overfishing (NS 1, FMP 1). Landings of preferred bottomfish, such as *opakapaka*, are in a state of decline (Ralston and Kawamoto, 1987). Excessive fishing effort is responsible for these declining catch rates among stocks located closer to Oahu (the port for most bottomfish landings). Unabated expansion of fishing effort contributes to declining catch rates. Instability of the fishery is perpetuated as operators continue to enter and exit the industry under such disequilibrous conditions. In the absence of regulation to restrict fishing effort, bottomfish stocks would continue to be overfished to unacceptably low levels.

II. Bottomfish habitat

Bottomfish habitat would suffer under a no action policy. Exploitation of the bottomfish resource would increase as the number of operators experimenting in the fishery continues to grow. Because of the overexploited condition of the fishery, many of these fishermen would operate on the short term. The problems for habitat and endangered species that are associated with a fishery composed of firms operating on a temporary basis are described in Sections 8.3.B.2.II and 8.3.B.2.III, respectively.

III. Endangered and threatened species

The same argument presented under Section 8.3.B.2.III is applicable under the no action policy. Fishermen having only a temporary involvement in the fishery are more prone to operate with short-term interests and sacrifice the future of the industry for present returns. Habitat, endangered wildlife, and the fishing stocks in general deteriorate, thereby impacting the long-term health of the fishery--all because of the short-term interest of fishermen operating in the bottomfish fishery under a no action policy.

IV. Other fish stocks

The argument presented in Section 8.3.B.2.IV is applicable under the no action policy. Fish stocks of alternative fisheries also suffer from the instability of the bottomfish fishery as vessels shift from bottomfishing to other fishing alternatives.

Table 12. Summary of biological effects of policy alternatives.

	Short term	Long term
Preferred alternative:		
1. Access management policy	+	+
Rejected alternatives:		
1. Direct effort regulations	-	+
2. Indirect effort regulations	-	+
3. No action	-	-

\+ = Beneficial impact
\- = Negative impact

8.4 Economic Impacts of Alternatives

A. Impact of Proposed Action

In developing the proposed access limitation policy, the Council took into account the items in Section 303(b)(6) of the MFCMA. Item C of that section requires the consideration of the economics of the fishery. In this portion of the amendment, the fishery's economics is addressed.

I. Fishery overcapitalization

Overcapitalization in the fishery is producing negative impacts on the financial health of the fishery. An increasing number of vessels are fishing a declining bottomfish resource. As a result, the present economic condition of firms operating in the NWHI bottomfish fishery is discouraging. Revenues are insufficient to cover total annual costs (Pooley and Kawamoto, 1988). Declining catch rates and changes in species composition in the catch are making fishing grounds located closer to landing ports less profitable. Operating costs are increasing as operators fish farther up the Hawaiian chain in search of more profitable fishing grounds. This amendment establishes controls to stop further capitalization in the fishery and facilitate its reduction over time with a minimum of short-term economic dislocation.

The 1986 fishing season is used as a standard for evaluating the economic impact of the proposed action on NWHI bottomfish fishermen. Based on specific

assumptions, the economic impacts on the gross revenue for the fleet and an average vessel that could result from the implementation of this amendment are presented in Table 13. Three estimated annual landings are described under the first assumption. The sources of these three estimates, 1) actual 1986 NWHI landings, 2) NWHI MSY under 1986 fleet conditions, and 3) MSY Ho'omalu Zone landings, are elaborated on below. Pooley and Kawamoto (1988) presented 784,000 lbs as the actual NWHI bottomfish catch landed in 1986. Ralston and Kawamoto (1987) identified the MSY for the fresh fish zone of the NWHI as 605,000 lbs (275 metric tons). It is assumed that a fleet the size of the 1986 fleet (29 boats) would continue to target solely for a fresh fish product. The estimated MSY for the Ho'omalu Zone is 601,000 lbs (273 metric tons) as described in Appendix A. This value is used for the estimated annual catch available to fishermen participating in the limited access zone after the amendment is implemented. It is assumed that these fishermen utilize the stock potential of the entire Ho'omalu Zone.

After the first year of the plan, the estimated fleet size for the Ho'omalu Zone is 21 vessels. This is a decline of eight boats after the implementation of the proposed action (from 29 to 21 vessels). This condition is based on the premise that the 8 boats coded as GG through NN in Table 1 (Section 6.1) are not grandfathered into the Ho'omalu Zone fleet, and the assumption that exit and entry of eligible grandfathered operators will balance out. Meyer (1987) estimated the "final" size of the fleets fishing in the Ho'omalu Zone and the Mau Zone to be 11 boats and 7 boats, respectively. He suggests that this balance between fleet catching power and NWHI bottomfish stocks may be achieved in approximately five years. Meyer's long-run scenario of an 11-boat Ho'omalu Zone fleet is presented in Tables 13 and 14, along with the comparisons of the economic situations in which a fleet is operating under the three conditions of estimated annual landings.

Ralston and Kawamoto (1987) reported that the 1986 landings by the fleet exceeded MSY by 18% and the fishery was in a state of disequilibrium. Total annual fleet landings must subside from that observed in 1986. In the absence of management, the gross revenue earned from landing NWHI bottomfish would decline 23% for the fleet and for the average boat, assuming constant prices. This downward trend in income, as it relates to catch, is inevitable because 1986 landings are not sustainable. Under the proposed action, gross revenue per boat is estimated to improve by 6% when compared to actual 1986 conditions, and 37% when compared to a scenario were MSY is landed by a fleet the size of that in 1986 (Table 13). Gross revenue per trip for the average boat is estimated to increase by 36% when comparing the proposed action to MSY landings under a policy of no action. These beneficial economic results occur as economic returns from the bottomfish resource are distributed among fewer fishermen. By reducing overcapitalization, the proposed action is estimated to provide to fishermen an increase in the economic benefits accruable from harvesting MSY.

Assumptions

1) Fleet landings:
   I. Actual 1986 NWHI landings = 784,000 lbs (Pooley and Kawamoto, 1987)
   II. Estimate MSY NWHI landings = 605,000 lbs (Ralston and Kawamoto, 1987)
   III. Estimate MSY Ho'omalu Zone = 601,000 lbs (Appendix A)
2) Average number of trips per boat per year = 7 (Meyer, 1987)
3) Average price in 1986 = $2.23 (Pooley and Kawamoto, 1988)

Table 13. Estimated gross annual economic impact on the fleet and the firm under actual conditions, a policy of no action, and the proposed policy.

Conditions		Actual NWHI 1986 Landings	NWHI MSY Landings (No action)	Ho'omalu Zone MSY Landings After the Amendment	
				First Year	Fifth Year
A. Total Landings (lbs)		784,000	605,000	601,000	601,000
B. Total Fleet Size		29(a)	29(b)	21(a)	11(c)
C. Trips/boat		7	7	7	7
D. lbs/boat (A/B)		27,000	20,900	28,600	54,600
E. lbs/trip (D/C)		3,900	3,000	4,100	7,800
F. price/lbs.	($)	2.23	2.23	2.23	2.23
G. Gross Rev./boat (F x D)	($)	60,200	46,600	63,800	121,800
H. Gross Rev/boat/trip (G/C)	($)	8,600	6,700	9,100	17,400
I. Gross Rev./fleet (A x F)	($)	1,748,300	1,349,200	1,340,200	1,340,200

(a) Based on fleet size value listed in Table 1 (Section 6.1).
(b) Assume no change from 1986 fleet size under MSY conditions.
(c) Based on Meyer (1987) estimated "final" fleet size.

II. Bottomfish market stability

This amendment should improve market stability and achieve the FMP objective of maintaining high quality products to consumers. It will create conditions conducive to maintaining MSY landings over time and thereby encourage the fishery's maximum contribution possible to the local fish market and consumers on a consistent basis.

Table 14. Estimated net economic impact on an average vessel fishing under three landing quantities for the total fleet: based on average net profit/loss per trip.(a)

Revenue/Cost Item	Based on Actual 1986 Landing Quantity (b)	Based on NWHI MSY Landing Quantity (c) (No action)	Ho'omalu Zone MSY Landings After The Amendment	
			1st Year	5th Year
A. Gross Revenue	$8,600	$ 6,700	$9,100	$17,400
-10% Auction Commission	860	670	910	1,740
B. Gross to Vessel	7,740	6,030	8,190	15,660
C. Variable Costs (Table 9)	4,231	4,231	4,231	4,231
D. Available to Skipper/Crew	3,509	1,799	3,959	11,429
E. Crew Share (40% of D)	1,404	720	1,584	4,572
F. Available to Owner	2,105	1,079	2,375	6,857
G. Fixed Costs (Table 9)	13,907	13,907	13,907	13,907
H. Available to Owner After Fixed Costs	-11,802	-12,828	-11,532	-7,050
I. Total Annual Loss (H X 7 trips)	-82,614	-89,796	-80,724	-49,350

(a) Values based on seven trips per year.
(b) Differs slightly from Table 10 in Section 6.3.3 because of underlying assumptions.
(c) Assuming 1986 fleet size = 29 boats (Table 1, Section 6.1).
(d) Assuming limited access fleet size = 21 boats (Table 1, Section 6.1).

III. Harvesting sector stability

The proposed action improves stability in the harvesting sector of Hawaii's bottomfish community by encouraging the presence of relatively permanent members within the industry. The remaining fishermen will be increasingly committed to the fishery as personal income begins to rise as a result of the implementation of this amendment.

IV. Profit maximizing fishermen

Comparing revenue estimates between "actual 1986 conditions" and the year after the amendment is implemented, the annual gross revenue per boat improves by approximately $3,600 (6%). Annual gross revenue per boat increases by an estimated $17,200 (37%) when an average vessel operating in a fleet the size of that existing in 1986 and landing the equilibrium of harvesting "NWHI MSY landings," is compared to an average boat fishing in a fleet of limited size landing the Ho'omalu Zone MSY. The cost formula used by Meyer (1987) provides an estimate of the operating and fixed costs for a typical bottomfishing vessel averaged across seven trips per year. Using this formula and the assumptions presented in Table 13, an estimate of the net economic impact of the proposed action is compared to 1) the 1986 disequilibrious situation and 2) the projected equilibrious condition under a policy of no action. The results are presented in Table 14.

If the NWHI MSY landing scenario is used as the base line, then the proposed action is estimated to increase an owner's profits, before fixed costs, by $1,296 (120%) when compared to the no action policy (Table 14). It is estimated that under the proposed action, vessels' financial loss will be reduced by 10% when compared to the no action scenario. Owners would still be operating their boat "in the red" if they fished for only bottomfish and made only seven trips per year. However, they would be losing less money, and the financial health of firms remaining in the fishery would continue to improve as the size of the fleet diminishes over time because of natural attrition. For example, under Meyer's estimate of an 11-boat fleet occurring five years after the plan, an owner's available income per trip increases $5,778 (535%) above the estimated income earned in the no action scenario. Comparing the estimated net economic impacts of an average vessel fishing under the no action scenario and that described five years after the plan indicates that a boat would be gaining approximately $40,000 more in revenues (losing $40,000 less) if the proposed action is adopted. The reader should be aware that this represents an "average" and does not reveal the full-time and part-time nature of the 11-boat fleet on which Meyer based his scenario. Meyer estimates full-time operators would have landings sufficient to cover both fixed and variable cost, while part-time multispecies vessel would cover only variable cost of three bottomfishing trips. Meyer's 11-vessel Ho'omalu Zone fleet is presented here to aid the reader in comparing an average boat's income under a long-run fleet estimate (Meyer, 1987) with the fleet size and landing observed in the past (actual 1986 condition), and two apposing, short-run (no action and first year under plan) fleet size and landing estimates.

This amendment does not impose inefficiencies on the fishing operations. As a result, fishermen are capable of minimizing the cost of

landing the fish. By their very nature, profit maximizing fishermen strive for increased efficiency while minimizing costs. The preferred alternative encourages these conditions in the fishery, thereby promoting efficiency (NS 5) while minimizing industry costs (NS 7).

B. Impact of Rejected Alternative Categories

1. Establish for the NWHI bottomfish fishery a different direct effort regulation policy

I. Fishery overcapitalization

Direct effort regulation policies are designed to produce positive, long-term economic impacts. They can be effective management tools for assisting fisheries suffering from overcapitalization. Removing excessive effort from the fishery rewards the efficiency and cost effectiveness of profit maximizing fishermen. As a result, the alternative direct effort policies achieve the efficiency (NS 5) and minimum cost (NS 7) objectives.

II. Bottomfish market stability

Detrimental impacts on market stability are associated with IFQ; effort they create changes in the timing of landings, especially in a fishery faced with substantial uncertainty.

III. Harvesting sector stability

A disadvantage of these regulation policies is the initial period of economic hardship that can occur when they are instituted. Marginally productive operators, who cannot afford the license fee or taxes on fishing effort would suffer economic loss and exit the industry. The Council believes an IFQ system would likely cause an unacceptably high number of firms to go out of business immediately as a result of quota scarcity. (Limited quotas would be necessary if the scheme is to be effective in removing effort from the fishery.) As a result, the short-term economic impact from abruptly implementing an alternative direct effort policy is considered to be negative. In contrast, both the short- and long-term economic impacts of the proposed action should benefit most bottomfish operators because of the policy's gradual approach to effort reduction.

An additional problem is the windfall benefit to fishermen grandfathered into the fishery if their quotas become saleable. The Council did not wish to establish a policy that would result in creating windfall profit associated with transferrable fishing rights.

IV. Profit maximizing fishermen

Economic theory of fisheries management supports direct effort regulation policies, which encourage profit maximizing behavior among fishermen. Operational freedom exists under these measures because fishermen are not burdened with the imposition of institutionalized inefficiencies.

While these advantages are identified with the alternative direct effort regulations, they are also associated with the preferred alternative.

2. Establish for the NWHI bottomfish fishery an indirect effort regulation policy

I. Fishery overcapitalization

Open access policies do not prohibit additional vessels entering the fishery and are an inefficient means to remedy overcapitalization. These policies may exacerbate the problem by encouraging further capital investment for vessel modifications designed to circumvent regulated inefficiency. In the short term, economic returns decline because of reduced landings caused by operational restrictions. In addition, too many boats fishing a declining stock causes economic returns to be spread thin among operators. Even in a scenario in which MSY is achieved by a fleet of 29 vessels, the average firm is estimated to generate approximately $2,400 less per trip than under the proposed action (Table 13).

II. Bottomfish market stability

Marketing channels are disrupted under some indirect effort policies because of the combined effect of allowing additional fishing boats into the fishery while constraining a specific aspect of fishing operations. Under such conditions, operators may find it justifiable to capture the majority of annual total catch in a relatively short period of time. This results in marketing bottlenecks, inconsistent supply of a quality product to consumers, low landing prices to fishermen, and high prices to consumers at other times in the year. These results indirectly conflict with FMP objectives. For these reasons, indirect effort policies are considered by the Council to negatively impact the stability of local bottomfish markets.

III. Harvesting sector stability

Under this policy approach, temporary participation could continue as fishermen come and go from the fishery. The composition of the fleet would likely continue to change. Vessels more capable of operating under the regulated inefficiencies could displace existing boats, adding to a further destabilization of the fishery. Further instability within the bottomfish fishery would be a negative, long-term economic impact of following a policy of indirect effort regulation.

IV. Profit maximizing fishermen

Indirect effort policies are designed to institute inefficiencies into the fishery in order to achieve biological objectives. These measures are not intended to be defended on economic grounds and prove deficient under such a criterion. For example, indirect effort regulations fail to minimize costs (NS 7). NOAA interprets this as minimizing industry costs as well as administrative and enforcement costs (50 CFR 602; 1-2055). Inefficiencies imposed on fishermen by an indirect effort policy increase operators' costs of fishing and further reduce income. The Council considers

the financial success of fishermen an important objective and rejects indirect effort policies on the basis of these costly inefficiencies.

3. No action

I. Fishery overcapitalization

The no action policy allows fishing effort to continue unabated. No mechanism will exist to reduce the number of entrants to the fishery or to constrain existing bottomfishing operations from expanding their vessels' fishing capacity. The problem of overcapitalization (FMP 7) is exacerbated under the no action policy.

II. Bottomfish market stability

Consumers suffer under a no action policy as excessive effort continues to fish down stocks, thereby reducing both the quality and quantity of desirable bottomfish species available to local fresh fish markets. A no action policy could not ensure against the negative impact overfishing has on market stability. Overfishing would result in annual landings well under MSY levels, thereby allowing the fishery to operate below its potential to supply bottomfish to the local markets. Product shortages would be more evident as NWHI bottomfish stocks became more difficult to locate. Prices could increase to consumers for specific products such as *opakapaka* that historically contribute a significant amount to local fresh fish markets. As a result, the no action policy fails to achieve FMP objective 6 established to maintain consistent availability of high quality products to consumers.

III. Harvesting sector stability

Economic disequilibrium would continue within the harvesting sector as more vessels test the fishery by entering and exiting on a temporal basis. Economic sectors of the fishing community are negatively impacted by such a policy in both the short and long term. The economic condition of the fishing community is destabilized by a transient bottomfishing sector. The financial health of bottomfish fishermen continues to spiral downward as they compete against an increasing number of fishermen for a portion of a declining resource.

IV. Profit maximizing fishermen

Under the assumptions set forth in Section 8.4.A.I, implementing a policy of no action, rather than the proposed alternative, would cost the average firm an additional total annual loss of approximately $9,000 (Table 14). This 10% decline in profitability per boat is based on the conservative assumption that the size of the fleet would not increase above the 1986 level. Economic returns per boat would worsen if the size of the fleet increases because of fishermen entering the fleet.

Table 15. Summary of economic effects of policy alternatives.

	Short term	Long term
Preferred Alternative:		
1. Access management policy	+	+
Rejected alternatives:		
1. Direct effort regulation	-	+
2. Indirect effort regulation	-	-
3. No action	-	-

+ = Beneficial impact.
- = Negative impact.

8.5 Social Impacts of Alternatives

A. Impacts of Proposed Action

I. NWHI bottomfish fishermen

The preferred alternative benefits NWHI bottomfish fishermen by allowing them greater responsibility in their prudent use of the resource. This policy enables fishermen to benefit from conservative fishing behavior that allows stocks to replenish while still harvesting acceptable landings. Prudent stewardship of long-term fishermen is no longer threatened by temporal fishing behavior of new entrants. Fishermen can have greater confidence that they will enjoy the future benefits of increasing yields due to their conservative fishing in the present. Participant longevity could be beneficial to the social structure within the fishing community as well as in the related industries. Establishing long-term professional associations within and outside the commercial fishing community should encourage stability and confidence by fostering personal and professional commitments.

II. Future access to NWHI bottomfish fishery

The policy allows eligible fishermen to enter the fishery in the future when bottomfish stocks and economic returns are sufficiently large to support more boats. The point system established to determine individuals "next in line" to enter the fishery is designed to select those individuals establishing themselves in the fishery over time. This amendment rewards an individual displaying a commitment to bottomfishing in the main Hawaiian Islands and in the Mau Zone, with the prospect of being able to enter the NWHI bottomfish fishery in the future. Fishing in these areas enables commercial operators to accumulate points to improve their eligibility for selection to join the fishery. This selection process ensures that these individuals are more likely to have a long-term commitment to the success and health of the fishery and its environment.

III. Stability in NWHI bottomfish fishery

Stabilizing the NWHI bottomfish fishery is an objective of this amendment. The preferred alternative accomplishes this objective by regulating the size of the fleet through continued participation, thereby discontinuing the influx of excess fishing effort.

IV. Flexibility for fishermen

The policy provides operational flexibility for bottomfish fishermen without the hindrance of regulated inefficiencies. With the freedom to operate efficiently fishermen achieve their business interest as well as the efficiency (NS 5) and least cost (NS 7) objectives.

B. Impact of Rejected Alternative Categories

1. Establish a different direct effort regulation policy for the NWHI bottomfish fishery

I. NWHI bottomfish fishermen

The Council considers individual quotas, license fees, and taxes on fishing effort to have overriding, negative social consequences upon NWHI bottomfish fishermen. The concept of fishing freedom is inherent to the unique cultural and social fabric of the western Pacific region, and management schemes that challenge this view are negatively received. Paying for fishing rights has been debated at length by the Council and members of the fishing community. Strong public opinion in opposition to such management regulations have been expressed. The concept of quotas has also been poorly received because many members of the community fear (rightly or wrongly) that these fishing rights will eventually become the possession of a few large corporations or wealthy individuals. The worry that smaller operations will be "bought out" or otherwise excluded from the fishery by the "big boys" is a very real concern existing in the commercial fishing community. As a result, alternative direct effort regulation policies were rejected, in part, on the basis of their social unacceptableness.

II. Future access to NWHI bottomfish fishery

Alternative direct effort regimes may tend to bias the fishery in favor of wealthier participants who can afford fishing taxes or fees or have the ability to bid quota shares away from operators with less financial strength. The long-term composition of the fishery could be one in which excessive shares or fishing privileges are accrued by a particular individual, corporation, or other entity. A fishery of this kind conflicts with the MFCMA (NS 4) which is concerned with such social factors. Concerns about this potential conflict contributed to the Council's decision to reject these alternative direct effort policies.

III. Stability in NWHI bottomfish fishery

Direct effort regulations such as IFQs may inadvertently be counterproductive to the stabilization of the fishery. For fishermen to have a long-term commitment to the industry, they must feel a certain degree of confidence in anticipated landings in future years. Quotas would likely be allocated on the basis of the productive health of the various individual stocks being exploited in this multispecies fishery. Not a great deal of information is presently available to facilitate the establishment of quota limits by species on which to base a system for IFQs. Because of this lack information, initial quotas would necessarily be conservative and could change considerably from year to year. Conceivably, fishermen would be unwilling to commit themselves and their resource for any great length of time to a fishery managed by a fluctuating quota system. A lack of commitment of long-term participation in the fishery could exacerbate the problem of fleet instability.

IV. Flexibility for fishermen

The alternative direct effort regulations are flexible to the degree fishermen can operate freely once they have met the initial criterion, such as paying the fee or tax. The regulation itself is not flexible but can allow operational freedom when conducting fishing at sea. An individual quota scheme also provides operational freedom up to the point the quota is reached. However, once the quota is met, fishing must stop for the remainder of the fishing season. Given the presently depleted condition of various bottomfish stocks, an initially low total quota, with low individual quotas, is very likely. If individual quotas must be set prohibitively low, fishermen would land their quota quickly and then shut down or search for other opportunities. Under this realistic scenario, an individual quota policy is poorly rated with regard to its flexibility for fishermen who wish to fish for bottomfish year round.

2. Establish an indirect effort regulation policy for the NWHI bottomfish fishery

I. NWHI bottomfish fishermen

The Council considers indirect effort regulation less beneficial to NWHI bottomfish fishermen than the proposed action. In the absence of a limited access policy, any beneficial results from these regulations will attract additional operators and be dissipated among the larger fleet.

II. Future access to NWHI bottomfish fishery

Indirect effort regulations enable free and open access into the fishery. However, this type of freedom, without any constraints on increases in fishing effort, is a primary cause for the fishery's presently overfished condition. Such an approach would only contribute to further degrading the fishery's productive potential.

III. Stability in NWHI bottomfish fishery

This policy exacerbates the problem of instability by not addressing the crucial issue of unabated expansion in fishing effort by new entrants. Instability is due to fishermen operating on a short-term basis as conditions change within the bottomfish fishery and alternative local fishing opportunities. Indirect effort regulations do not encourage long-term commitments to the bottomfish fishery. This destabilizes the social fishing community of permanent bottomfish fishermen as well as those long-term operators in other local fisheries.

IV. Flexibility for fishermen

Indirect effort policies promulgate inefficiencies in the industry, thereby reducing fishermen's operational flexibility. Operators are put at a disadvantage in order to reduce their fishing success. Frequently, under an indirect effort policy, there is a recurring need to add more constraints because fishermen are continually working around the initial regulated inefficiency. In the long-run, the fishery becomes increasingly inflexible.

3. No action

I. NWHI bottomfish fishermen

If no action is taken to regulate fishing effort in the NWHI bottomfish fishery, overfishing will continue and the long-term productivity of the stock will be in jeopardy. This approach fails to meet NS 1 and FMP objective 1 and conveys no concern for the social well-being and continued existence of the bottomfishing community in Hawaii. Hawaii's fishing community at large would be justifiably concerned over the Council's failure to attempt responsible management of the NWHI bottomfish fishery.

II. Future access to NWHI bottomfish fishery

Under a policy of no action, access into the fishery will continue uncontrolled as it has in the past. This approach would essentially condone increasing the fishing pressure on a presently overexploited resource.

III. Stability in NWHI bottomfish fishery

A policy of no action would encourage the perpetuation of instability in the fishery.

IV. Flexibility for fishermen

The present condition of the fishery is one of tremendous flexibility. In direct response to this flexibility, there are considerable problems associated with the overall health and future productivity of the fishery. Establishing no further management measures would protect the fishery's flexibility at the expense of exacerbating its problems.

Table 16. Summary of social impacts of policy alternatives.

	Short term	Long term
Preferred Alternative:		
1. Access management policy	+	+
Rejected Alternatives:		
1. Direct effort regulation	-	-
2. Indirect effort regulation	-	-
3. No action	-	-

\+ = Beneficial impact
\- = Negative impact

8.6 Enforcement and Administrative Impacts of Alternatives

A. Impact of Preferred Alternative

I. Legality under MFCMA

The preferred alternative, which is a fishing opportunity allocation scheme for the NWHI bottomfish fishery, must satisfy issues identified within NS 4 to be legal under the MFCMA. The plan does not create markets for shares in the fishery and avoids establishing circumstances conducive to the establishment of inordinate control by any particular individual, corporation, or other entity.

Discretionary provisions that also must be addressed for an access limitation proposal are as listed under Section 303 of the MFCMA. These requirements state that, in the process of developing an access limitation policy, the following issues must be considered: 1) present participation in the fishery, 2) historical fishing practices, 3) the economics of the fishery, 4) capability of vessels to engage in other fisheries, and 5) the cultural and social framework relevant to the fishery. A further discussion on the proposed action's adherence to these issues is summarized in Section 9.11 of this document.

II. Absence of illegal discrimination

No discrimination among residents of different states exists in the plan. Under this amendment, the privilege to fish is assigned on the basis of time of prior participation (i.e., fishery participation prior to August 7, 1985), and no discrimination exists between persons residing in different states (NS 4).

III. Minimization of necessary regulation

The Council considered this amendment to be the best alternative to meet the objectives of the MFCMA and the FMP while minimizing the amount of regulations necessary to achieve that goal. The proposed action encourages participants to self-regulate in the interest of the resource and their own future as bottomfish fishermen.

IV. Minimization of necessary enforcement costs

The preferred alternative does not alter the ongoing $809,000/year cost for bi-weekly surveillance (with the multiple fishery as well as non-fishery enforcement and safety missions of the U.S. Coast Guard over the NWHI as presented in Section 10.2 of the FMP). Self-monitoring becomes inherent as personal interests motivate operators to investigate bottomfishing activity conducted by any vessel not qualifying in the fishery. This type of "self-surveillance" would occur in both the Ho'omalu Zone (within which access is limited) and the Mau Zone (within which access is not allowed to Ho'omalu Zone permit holders). The two groups would essentially police each other to a certain degree. Cooperation between enforcement officials and fishermen is heightened under this amendment, and no additional presence of Federal enforcement officials on the high seas is anticipated. Dockside inspections would continue to be the primary enforcement mode.

V. Minimization of administrative costs

Increases in administrative costs are minimized under the limited access proposal. Additional costs may come from the creation of the Advisory Review Board which could meet as often as four times annually. However, only 3 out of 10 board members (2 fishermen and 1 market representative) would require travel costs or per diem when attending a board meeting. Most bottomfish fishermen and marketing or processing representatives reside on the island of Oahu, where the majority of the meetings would be held. These administrative costs would be reduced further if the non-government board members need not travel off the island to attend board meetings. Remaining members are locally stationed government employees and require no additional remuneration for board participation.

B. Impact of Rejected Alternative

1. Establish a different direct effort policy for the NWHI bottomfish fishery

I. Legality under MFCMA

The alternative direct effort regulation policies considered by the Council include IFQs, license fees, and taxation. Fishery economists recommend direct effort regulations on the basis of their ability to promote economic efficiency. As with the preferred alternative, these policies cater to profit maximizing fishermen by allowing them operational freedom. They are designed to specifically address fisheries suffering from overcapitalization and unstable economic markets. Despite these advantages,

the implementation of license fees and taxes in excess of administrative costs are specifically disallowed under the MFCMA [602.15(c)(1) 50 CFR 602, pp. 1-2044]. For this reason, the Council rejected these two alternative direct effort policies. Because adequate taxes or license fees are not allowed under the MFCMA, they are not evaluated further under the remaining criteria in this section.

II. Absence of illegal discrimination

In concept, there is no discrimination between persons residing in different states associated with these alternative direct effort policies that the Council has considered.

III. Minimization of necessary regulation

An individual quota scheme is rejected by the Council in part, due to its incompatibility with a multispecies fishery. Individual quotas are considered incompatible because a quota would be necessary for each species in the bottomfish fishery. Regulations associated with each species for each individual quota are conceivable under such a policy. An elaborate regulatory system could become necessary to ensure the success of quotas if implemented in this fishery. At this time, the Council views the regulatory requirements of such a policy to be prohibitive.

IV. Minimization of necessary enforcement costs

The Council considers an individual quota policy too costly, in terms of enforcement, to be effectively implemented. Increased surveillance would be required to ensure less desirable bottomfish are not discarded in attempts to fill individual quotas with more profitable species. Dockside inspection could become increasingly time consuming and expensive if enforcement officers are required to identify fish by species in order to ascertain whether quotas are being adhered to for different fish groups. The overall enforcement complexities associated with this approach make it less preferable for managing the fishery.

V. Minimization of administrative costs

Individual quotas would require considerably more scientific and administrative resources to be properly established and implemented than would the proposed action. Significantly more detailed information would be required from fisheries scientists in order to provide a basis for establishing the quotas. Research and data collection become increasingly critical for stock assessment and revision of individual quotas. Much of the information is not presently available, and considerably more research would be needed before quotas could be confidently quantified. The Council considers the time and cost requirements associated with developing an individual quota system to preclude its being pursued at the present time.

2. Establish an indirect effort regulation policy for the NWHI bottomfish fishery

I. Legality under MFCMA

The MFCMA provides the latitude to accommodate the implementation of an indirect effort regulation policy.

II. Absence of illegal discrimination

Generally, no illegal discrimination is associated with indirect effort regulations.

III. Minimization of necessary regulation

Following an indirect effort management approach will, in the long term, result in a highly regulated fishery. For example, as fishery managers impose restrictions on effort to maintain the desired level of catch, fishermen circumvent the regulation by modifying some other aspect of their operation. Managers must consequently establish another regulation to further curb effective fishing effort, and the cycle continues. This result directly contradicts the objective to minimize necessary regulation and unnecessary duplication (NS 7).

IV. Minimization of necessary enforcement costs

This management approach tends to impose substantial burdens on enforcement agencies to adequately monitor compliance within the fishery. The cost of enforcing an ever-increasing number of effort regulations would eventually become prohibitive. Continued public support for a management policy is important to its success. Indirect effort regulations impose operational inefficiencies at fishermen's expense. Rarely, if ever, is such action popular in the fishing community. Generating supportive participation in the design and implementation process of such a policy would be a formidable task for administrative and enforcement officials.

V. Minimization of administrative costs

Under an indirect effort policy, administrative costs increase in the long term as additional regulations are imposed to limit catch and maintain effective reductions in fishing effort. Fishermen work around regulated inefficiencies by modifying some other aspect of their fishing operation to increase fishing effort. The cost of administration grows with each additional effort regulation. As a result, open access policies are unable to achieve the cost minimizing objective (NS 4).

3. No action

I. Legality under MFCMA

Establishing no additional management measures in the NWHI bottomfish fishery is legal under the MFCMA, except that it will not reduce chances of overfishing.

II. Absence of illegal discrimination

Following a policy of no action would not establish any illegal discrimination in the fishery.

III. Minimization of necessary regulation

The short-term implication of a no action policy would result in no further regulations imposed in the NWHI bottomfish fishery. However, in the absence of some type of restrictive fishing effort policy, more severe regulation measures would likely be needed in the future to protect the resource. Establishing preventive management in the present will minimize necessary regulation in the future.

IV. Minimization of necessary enforcement costs

A policy of no action would perpetuate the status quo for existing enforcement procedures without adding or reducing costs or responsibility to management agencies in the short term. However, enforcement costs in the long term could be excessive if expensive management measures are later required to protect the resource because of past management neglect.

V. Minimization of administrative costs

Such a policy could result in higher administrative costs when the Council needs to seek more stringent management measures to protect the fishery in the future. Negative political ramifications also result from taking a no action approach to the NWHI bottomfish fishery. Public opinion among members of Hawaii's fishing community would turn unfavorable toward the Council because of its failure to attempt responsible management of the bottomfish fishery. Future participation in the regulatory process by members in the fishing community would decline as their perception of the value of management bodies deteriorates. The loss of this valuable input would negatively impact the long-term effectiveness of administrative and enforcement goals.

Table 17. Summary of administrative and enforcement impacts of policy alternatives.

	Short term	Long term
Preferred Alternative:		
1. Access management policy	+	+
Rejected Alternatives:		
1. Direct effort regulation	-	-
2. Indirect effort regulation	-	-
3. No action	0	-

+ = Beneficial impact.
- = Negative impact.
0 = No impact.

8.7 Summary of Impacts of Proposed and Rejected Alternatives.

Presented in this section are three tables designed to aid the reader in summarizing the impacts of the various fishery management alternatives as they apply to the MFCMA NS, FMP objectives, and the objectives of this amendment. The rating code used in these tables is described below:

```
++  =  Strong beneficial impact
 +  =  Moderate beneficial impact
 0  =  No impact or not applicable
 -  =  Moderately negative impact
--  =  Strong negative impact
```

Table 18. Impact summary of proposed action and alternatives (Alt.): based on compliance to FMP objectives.

FMP Objectives	Proposed Action	No Action	Other Direct Effort Alt.	Indirect Effort Alt.
Protect against overfishing	++	--	++	+
Provide management framework	++	--	+	+
Protect stocks and habitat	++	--	+	-
Maintain quality market product	++	-	+	-
Prevent over-capitalization	++	--	+	--
Minimize adverse impacts on habitat and endangered species	++	0	0	-

Table 19. Impact summary of proposed action and alternatives (Alt.): based on compliance to MFCMA NS.

MFCMA N.S.	Proposed Action	No Action	Other Direct Effort Alt.	Indirect Effort Alt.
Prevent overfishing	++	--	++	+
Based on best information	+	0	0	0
Manage stock(s) as one unit	++	0	0	0
No discrimination by State residency	+	+	+	+
Promote efficient resource use	++	--	+	--
Management flexibility	+	0	+	--
Minimize administrative and enforcement costs	+	-	-	--

Table 20. Impact summary of proposed action and alternatives (Alt.): based on compliance to amendment objectives.

Amendment Objectives	Proposed Action	No Action	Other Direct Effort Alt.	Indirect Effort Alt.
To reduce overfishing	++	--	++	+
To reduce overcapital-ization	++	--	+	-
To increase fishery stability	++	--	-	-
To increase the fishery's profitability	++	--	+	--

9.0 DETERMINATIONS

9.1 Maximum Sustainable Yield

This amendment contains a revised estimate of the MSY for NWHI bottomfish. The estimate for the MSY in the bottomfish FMP was derived by extrapolating the yield estimate of 272 kg/per nautical mile of the 200-meter depth contour (Ralston and Polovina, 1982). Results from a more recent analysis conducted by the NMFS Honolulu Laboratory established a yield estimate of 286 kg/nautical mile of 100-fathom contour (Ralston, 1986). The length of the 100-fathom contour for the NWHI is 1,231 nautical miles. The revised estimate of MSY for bottomfish for the entire NWHI at 352 metric tons.

The NWHI fishery for bottomfish is at present only a fresh fish fishery. Extended travel time to and from the northernmost parts of the Hawaiian Archipelago precludes most fishing operations returning to port (Honolulu) with a marketable fresh fish product. For this reason, MSY is also estimated for the "fresh fish portion" of the NWHI. The MSY for bottomfish in their NWHI fresh fish zone (Nihoa to Lisianski Island) is estimated to be approximately 275 metric tons (Ralston and Kawamoto, 1987). The fresh fish access zone comprises all of the Mau Zone and nearly two-thirds of the Ho'omalu Zone, as describe under the limited access program. To estimate MSY for both the Ho'omalu Zone and the Mau Zone, island-specific MSY estimates must be used. The most current island-specific MSY estimates using the 286 kg per year per nautical mile production estimate are found in a memorandum dated March 1986 from Dr. Steve Ralston (NMFS biologist) to the Council-appointed Bottomfish Plan Monitoring Team. Ralston estimates MSY for the Mau Zone (Nihoa and Necker Island) to be 78.9 metric tons and the Ho'omalu Zone (French Frigate Shoals to Kure Island) to be 273.2 metric tons. Ralston's memorandum is presented in Appendix A.

9.2 Optimum Yield

The optimum yield for the NWHI bottomfish fishery is defined non-numerically in the FMP as the amount of bottomfish caught by fishermen within the Federal Coastal Zone that will achieve FMP objectives to the greatest extent practicable. The objectives directly applicable to this amendment are presented below.

A. Maintain long-term productivity of bottomfish stocks.

B. Maintain a balance between harvest capacity and harvestable fishing stocks to prevent overcapitalization and provide consistent supplies of high quality fish to consumers.

C. Protect bottomfish stocks, habitat, and associated endangered and threatened species from adverse effects of destructive or indiscriminate fishing activities.

The definition of optimum yield has not been affected by this amendment. At the time the FMP was developed, the Council estimated the quantity of

bottomfish expected to be taken in the NWHI under the FMP as between 400,000-700,000 pounds per year (FMP, 1986). This is approximately equivalent to between 182 and 318 metric tons. The most current estimate of MSY indicates that annual "sustainable" yields of fresh fish landings beyond 275 metric tons are not possible in the NWHI bottomfish fishery. Under this amendment, 28% and 72% of these fresh fish landings would be distributed between the Mau Zone (78 metric tons) and the Ho'omalu Zone (198 metric tons), respectively. Price and revenue effects are also essentially neutral in the MSY range. Notwithstanding the non-numeric definition of optimum yield, the Council estimates the annual harvest associated with optimum yield to be less than or equal to MSY. The estimates of MSY and optimum yield are not to be construed as quotas for the fishery, but rather as revised yield estimates.

9.3 Domestic Harvest

The fishing capacity for NWHI bottomfish is substantial enough to harvest the optimum yield. Supporting evidence is found in catch figures for 1985 and 1986: Catch for the fresh fish access zone surpassed the MSY by 8% and 18%, respectively. The amendment does not directly lessen fishing effort below the level needed to land the MSY and optimum yield. Therefore, domestic annual harvest is estimated as equal to optimum yield.

9.4 Total Allowable Level of Foreign Fishing

The domestic fishery has the capability and intent to harvest the entire optimum yield from the fishery. Therefore, the total allowable level of foreign fishing is zero.

9.5 Domestic Annual Processing

This amendment has no effect on the domestic annual processing estimates described initially in the FMP. There is no domestic processing of the management unit species in the industrial sense. The only imaginable processing that could occur would be the manufacture of "surimi." However, this possibility is unlikely, given the relatively high price and limited supplies of bottomfish. All of the landings of bottomfish presently enter local markets in fresh product forms. At this time, there is no reason to believe that the domestic annual processing will be other than zero.

9.6 Joint Venture Processing

Harvesting capacity does not exceed that presently utilized by the fleet and sold through domestic market channels. Therefore, the amount of bottomfish available for joint venture processing is zero.

9.7 Consistency to MFCMA National Standards

Selection of the preferred alternative was based, in part, on how well it was consistent with the seven NS set forth within the MFCMA. The seven NS are presented below as an added reference for the reader.

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the U.S. fishing industry.

The preferred alternative directly supports the prevention of overfishing by capping fishing effort and facilitating its reduction. The amendment enables the achievement of non-numeric optimum yield for the NWHI bottomfish fishery as described in Section 9.2.

2. Conservation and management measures shall be based upon the best scientific information available.

This amendment was constructed with the best available information provided by scientists and other professionals within the Federal (NMFS) and State government.

3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

The NWHI fishery for bottomfish is composed of several species of bottomfish. They share similar habitat and are fished by the same operators using comparable gear. The bottomfish FMP recognizes these similarities and attempts to manage NWHI bottomfish stocks as one unit. The proposed amendment is consistent with the singular management unit approach to the NWHI bottomfish fishery.

4. Conservation and management measures shall not discriminate between residents of different states.

This amendment proposes a limited access scheme that determines eligibility on the basis of historic participation. The State residency of operators is not a factor. The grandfathering component of the plan is equitable to all. Any vessel owner who presents appropriate documentation of bottomfish landings made by his vessel prior to the August 7, 1985, cutoff date is eligible. In addition, the plan allows any fisherman to gain future access into the NWHI bottomfish fishery by demonstrating personal participation as a non-owner skipper of an eligible vessel prior to the cutoff date. The individual can earn eligibility points through bottomfishing in the main Hawaiian Islands and in the Mau Zone. Finally, the access limitation amendment is designed to avoid inequitable distribution of fishing privileges to individuals, corporations, or other entities.

5. Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

Unlike some other effort limitation schemes, this amendment does not institute inefficiencies into the industry. Under this amendment, fishermen remaining in the fishery are given the freedom to manage their operation

without additional regulations and are encouraged by the profit motive to maximize efficiency to the extent they desire.

6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The amendment includes establishment of an Advisory Review Board composed of members from the scientific and fishing community. The Board will receive an annual report on the bottomfish fishery from the Plan Monitoring Team. The Board will monitor the fishery's progress and make recommendations to the Council of any adjustment needed to accommodate fluctuations observed in the fishery and its resources. The FMP and the limited access program are designed with flexibility in mind and provide opportunity for the Council to respond quickly in the event contingency adjustments are required under the FMP's framework process.

7. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

Alternative management measures were considered to determine whether any would achieve the Council's objectives without imposing unnecessary burdens on the fishery. The disadvantages varied among alternatives and included the following negative impacts: 1) additional operating costs to fishermen, 2) increases in administrative and enforcement costs resulting from more complex regulations, and 3) negative changes in product availability and price to consumers. In contrast, the proposed amendment is intended to bring about beneficial impacts in these areas. The plan achieves the objectives of the FMP while accomplishing the following: 1) causes no increase in capital outlay or operating or maintenance costs to fishermen remaining in the fleet, 2) imposes no significant new burdens on administrative or enforcement resources, and 3) stabilizes the supply of bottomfish to fishermen and to consumers. For these reasons, the Council determined the limited access plan presented in this amendment is the most cost-effective means of achieving the FMP objectives.

9.8 Description of Habitat

Depending on the species, adult bottomfish of the NWHI inhabit depths from 40 to 145 fathoms (Table 21). The habitat of the six most important species of bottomfish listed below tends to overlap, as indicated by the depth range at which the fish can be hooked. Even with this overlap, certain species are still more common at specific depths. This factor, along with other individual biological characteristics, enables NWHI fishermen to target individual species.

Depth alone does not assure satisfactory bottomfish habitat as evidenced by variations in catch rates occurring along the same depth contour. The quantity and quality of benthic habitat are important to determine suitable bottomfish environment and how habitat varies around each island and bank of the NWHI. The underwater habitat of bottomfish consists of a mosaic of sandy and rocky areas. In addition, benthic relief in the NWHI varies dramatically from gently sloping atolls to abrupt dropoffs associated with pinnacles and

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banks. These environments of the bottomfish habitat have insufficient sunlight to support an abundance of algae (calcarious or otherwise) or coral. However, some corals, such as black coral (Antipathes spp.), have been observed at depths corresponding to shallow bottomfish habitat at ranges from 15 to 50 fathoms (FMP, 1980).

Bottomfish species may be attracted to similar habitat but appear to have negligible multispecies interactions (Ralston and Polovina, 1982). Supportive of this view is Polovina's (1987) perception of weak predator-prey relationships among NWHI bottomfish. His observation is based on trophic data presented by Parrish (1987). Low multispecies interaction in the bottomfish community may be caused by the establishment of territorial strongholds by particular species. In addition, variations in the way different bottomfish utilize habitat are known to occur. For example, *opakapaka* is believed to migrate into shallower depths during the night hours. *Onaga* is caught in considerably deeper water and is associated with abrupt relief zones such as outcroppings, pinnacles, and dropoffs (DLNR, 1979). In a consolidated report on snappers and groupers, Parrish (1987) references findings indicating groupers are generally much more sedentary than snappers and are more dependent on hard substrates (Hiatt and Strasburg, 1960). These behavioral characteristics may help explain the absence of direct multispecies interaction between the various snappers and groupers found in the fishery.

Conclusive evidence identifying habitat requirements for juvenile bottomfish has not yet been obtained. Sampling attempts to capture juveniles have been made at depths ranging from relatively shallow water to 100 fathoms. Thus far, sampling efforts conducted by NMFS scientists have proven unsuccessful in capturing juvenile bottomfish. This has led to the current hypothesis that juveniles inhabit depths below the adult population and migrate upward as they mature.

Table 21. Habitat depth range for dominant Northwestern Hawaiian Islands bottomfish.

Species	Hooking Depth Range (in Fathoms)	Average
Opakapaka	30-110	70
Onaga	100-150	125
Hapu'upu'u	50-150	100
Butaguchi	40-100	70
Ehu	110-180	145
Uku	20-60	40

(Source: FMP, 1986.)

9.9 Conditions of the Bottomfish Habitat

The deepwater habitat of NWHI bottomfish is relatively pristine. Human-induced impacts on the bottomfish habitat can arise from three major sources:

1. Anchors used by vessels attempting to maintain position over productive bottomfish habitat.

2. Heavy weights and line entanglement during normal hook-and-line bottomfish operations.

3. Illegal foreign fishing activities for precious corals by using dredges.

These three sources of damage are considered to occur on a very small percentage of the NWHI bottomfish habitat and are probably not significantly detrimental. For the most part, live coral is absent at depths where the majority of bottomfishing occurs. Coral rubble and small basalt rocks may be rearranged in the process of anchoring, but the effect is probably not significant.

Regulations have been implemented under the FMP to prohibit the use of bottom trawls, bottomset nets, explosives, and poisons for harvesting bottomfish. These measures, while having direct biological implications, also have direct positive impacts on preserving the condition of bottomfish habitat. This amendment makes no changes in these regulations and would lower potential habitat damage by decreasing the fleet size and correspondingly reduce interaction between commercial fishermen and bottomfish habitat. Under the proposed access limitation plan, no additional degradation of bottomfish habitat would occur.

9.10 Vessel Safety Issues

By memorandum, a vessel safety consultation was requested of the U.S. Coast Guard to evaluate this amendment and its implications to the safety of fishing vessels operating in the Ho'omalu Zone. Special attention has been given to the establishing a vessel length limit of 60 feet, under the proposed amendment. The memorandum requested U.S. Coast Guard consideration of the 60-foot size limit component of this amendment. The Coast Guard's official response is as follows: "Amendment #2 does not call for temporary adjustments, such as altering a closure schedule, to accommodate fishing vessels prevented from harvesting by weather or other ocean conditions affecting vessel safety. Consequently, there is no issue in this amendment to be addressed by the Coast Guard within the statutory guidelines of the MFCMA." A copy of the Coast Guard's letter is available in Appendix E.

9.11 Discretionary Provisions

Section 303 of the MFCMA deals with the "Contents of Fishing Management Plans." The contents section is subdivided into two parts: 1) required

provisions and 2) discretionary provisions. The required provisions have already been discussed, but several of the discretionary provisions are relevant and appropriate to this amendment.

Any fishery management plan proposed by the Council with respect to any fishery may do the following:

6) Establish a system for limiting access to the fishery to achieve optimum yield, if, in developing such a system, the Council and the Secretary take the following into account.

(A) Present participation in the fishery: Present and past participation is the criterion for eligibility. This topic is discussed in Section 3.4, Chapter 6.0 Section 6.1, and Table 1.

(B) Historical fishing practices in, and dependency on, the fishery: Continued participation will be necessary to maintain eligibility; those dependent on the fishery will be protected. The subject of indigenous fishery rights is discussed in Section 10.8.

(C) The economics of the fishery: The amendment seeks to improve the fishery's economics by allowing MSY/optimum yield to be taken by a smaller number of vessels and by maintaining the balance between harvest capability of vessels and ability of stocks to yield harvest. This topic is discussed at some length in Sections 6.3 and 8.4.

(D) The capability of fishing vessels used in the fishery to engage in other fisheries: Many boats presently in the fishery engaged in fisheries elsewhere before they came to Hawaii. While in Hawaii, some of these boats fished longlines for bigeye tuna and yellowfin tuna, while others trolled for albacore. A few of the boats have fished for lobster. Bottomfish fishermen have the capability to engage in other fisheries, and some of them only fish for bottomfish part time.

(E) The cultural and social framework relevant to the fishery: The Council and the Office of Hawaiian Affairs are jointly sponsoring research in this area. The subject of native Hawaiian fishing rights is reserved until the research is finished.

10.0 RELATIONSHIP OF AMENDMENT 2 TO OTHER APPLICABLE LAWS AND POLICIES

10.1 Compliance with Hawaii Coastal Zone Management Policies

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all Federal activities directly affecting the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. This amendment will create a difference between Hawaii and Federal regulations concerning the eligibility of permit holding fishermen in the NWHI bottomfish fishery.

The State of Hawaii requires a Commercial Marine License ($25 residence fee and $50 non-residence fee) to be obtained by individuals or vessels engaged in taking, selling, or offering for sale any marine life for commercial purposes. The term "commercial purposes" is defined as taking of marine life for profit or gain or as a means of livelihood when the marine life is taken in or outside of the State, and when the marine life is sold, offered for sale, or landed, or transported for sale anywhere in the State (DLNR, 1987). In addition, the State requires a Northwestern Islands Taking Permit ($1 fee) of persons fishing for commercial purposes in the NWHI. Presently, there is no permit eligibility criterion. Any person may purchase these permits and enter the commercial fisheries of the NWHI. Under Amendment 2, Federal regulations would establish eligibility criteria for permit holders operating as commercial NWHI bottomfish fishermen. As a result, implementing the proposed amendment would initially cause an inconsistency, between State and Federal regulations identifying legal permit holders. If the State acts to alleviate this inconsistency it must either produce its own limited access plan or simply adopt the Federal policy set forth in this amendment.

The State has an entirely different set of procedures that must be followed before changes can occur, particularly if regulations are statutory. Therefore, even though the Council and the State attempt to establish complementary management measures, the timing of such changes is practically never synchronized.

A consultation has been requested from the State of Hawaii to address the amendment's consistency with Coastal Zone Management. Given the management needs of the fishery, the Council considers Amendment 2 to be consistent to the maximum extent practicable with Hawaii's approved Coastal Zone Management Program.

10.2 Marine Mammal Protection Act

Passage of the Marine Mammal Protection Act in 1972 committed the United States to long-term management of these animals. In compliance with this statute, the Council established objective 8 in the FMP which states the following:

> "Avoid the taking of protected species and minimize possible adverse modifications to their habitat."

There is no evidence that bottomfishing practices have any effect on marine mammals in the NWHI. The FMP also established restrictions in the fishery to prevent use of gear or techniques that could prove especially hazardous to marine mammals and their habitat. The use of bottom trawls, bottomset gill nets, poisons, and explosives is prohibited in the fishery.

The proposed amendment makes no changes in the FMP that would be detrimental to marine mammals inhabiting the NWHI. The amendment would likely be to their benefit because 1) interaction between fishermen and marine mammals would decline as the number of NWHI fishermen is reduced, and 2) permit holders must participate in a NMFS-U.S.Fish and Wildlife Service workshop to ensure their familiarity with concerns involving marine mammal and endangered and threatened species in the NWHI.

10.3 Endangered Species Act

The Endangered Species Act Section 7 consultation noted the NWHI bottomfish fishery would potentially impact endangered or threatened species via entanglement in fishing lines. The consultation identified the endangered Hawaiian monk seal and the threatened green turtle as species that could potentially suffer entanglement due to NWHI bottomfishing. The consultation concluded that the implementation of the FMP regulations would reduce the risk of entanglement to these species and this amendment makes no changes in those regulations.

Establishment of the proposed amendment could beneficially impact endangered and threatened species inhabiting the NWHI. The amendment will reduce the number of boats in the area and require all remaining fishermen to attend an information workshop on endangered and threatened species. The workshop is intended to further reduce the risk of commercial fishing negatively impacting these animals.

The NMFS has designated critical habitat for the Hawaiian monk seal in parts of the NWHI. This amendment will not cause, or result in, modification of that habitat and may have long-term benefits. Reduced bottomfishing effort would lower the potential for vessel groundings or other accidents, and the endangered species workshop will ensure that vessel owners and operators are aware of possible problems if care is not taken. The Council has initiated consultation with NMFS to ensure that requirements of the Endangered Species Act are met. The regional Director responded by acknowledging that this amendment "will not likely adversely affect listed species and will not substantively alter the conclusions in Biological Opinion issued by NMFS for the Bottomfish FMP on February 10, 1986. Accordingly neither formal consultation nor reiteration of consultation under Section 7 of the ESA of 1973, as amended, will be required for this action." A copy of the Regional Director's consultation is presented in Appendix D.

10.4 National Environmental Policy Act - Environmental Assessment

The need for this amendment, the actions proposed, and the impacts of those actions are discussed in Section 8.3. The proposed amendment is not a significant Federal action requiring preparation of an Environmental Impact

Statement. The environmental assessment incorporated in the revised FMP met National Environmental Policy Act requirements. The management measure (access limitation) proposed in this amendment was considered under the FMP framework (Section 6.3.5) and therefore, is covered under the FMP Environmental Assessment. In addition, the amendment does not expand the original proposal of the FMP or change its environmental impacts. As a result of these factors, the proposed amendment qualifies for Categorical Exclusion under NOAA Directive 02-10, Section 5c(3)(f).

10.5 Documentation for a Finding of No Significant Environmental Impacts Under NEPA

The proposed amendment will not significantly impact the quality of the marine or human environment of the NWHI. It should not result in impacts significantly different in context or intensity from those described in the Environmental Impact Statement published with the initial regulations implementing the approved bottomfish FMP. The FMP contains an environmental assessment that meets the National Environmental Policy Act requirements and was accepted by the NOAA Office of Policy and Planning. Documentation for the finding of no significant environmental impact under NEPA is identical to that recorded in Section 8.8 of the bottomfish FMP(1986).

10.6 Determination of Impacts Under Executive Order 12291 and the Regulatory Flexibility Act

The proposed actions are not considered major as defined under Executive order 12291. None of the impacts, individually or collectively, resulting from this amendment will have an annual effect on the economy greater than or equal to $100 million. Based on ex-vessel sales, the NWHI bottomfish fishery was worth $1.9 million in 1986. The implementation of the plan will not cause major increases in prices for consumers because supply to local bottomfish markets will not be hindered. The NWHI bottomfish represent less than 40% of bottomfish sold at the wholesale market (Pooley and Kawamoto, 1988). If the contribution of NWHI bottomfish to the wholesale market declines in the future, it will not be due to this amendment because fishing capacity capable of harvesting MSY will still exist in the fishery. Industries or government agencies will not incur major cost or price increases due to this amendment. As mentioned in Section 9.7.7, the Council considers the plan to be the most cost-effective approach to achieving FMP objectives while adhering to the MFMCA NS.

The Regulatory Flexibility Act (RFA) requires that agencies evaluate the impacts of their regulation on affected businesses and to consider adjustments to those regulations if necessary to avoid a significant adverse impact on a substantial number of small business entities. The necessary components of an initial regulatory flexibility analysis are available within this document. The issues required in the analysis and the sections in which they are discussed within this document are presented below.

A. Description of reason why action is considered.

The fishery is experiencing overcapitalization and declining catch rates. As a result, economic survival of NWHI bottomfish fishermen has become threatened. A detailed description of these conditions is presented in Chapter 6.

B. Statement of objectives of proposed rule.

The objectives of this amendment are to reduce overfishing and overcapitalization while increasing stability and profitability within the fishery. These four objectives are stated in Section 8.0.

C. Where feasible, a description of the number of small businesses to which the proposed rule would apply.

The Council acknowledges that virtually all of the fishermen affected by this proposed rule would classify as "small businesses". The exact numbers of fishermen eligible to be grandfathered into the fishery is not known, and even if it were calculated from the State of Hawaii catch records (which date back to the early 1940's), it would not reveal who would actually exercise their option to enter the fishery. What is available is the number of vessels operating in the fishery in 1986 and an estimate of whether they were full-time or part-time fishermen in the NWHI. Meyer (1987) estimated the percentage of vessels fishing in the Ho'omalu and Mau Zones were 81% and 19% of the fleet, respectively. Of those fishing the Ho'omalu Zone, approximately 23% were part-time and 77% full-time bottomfish fishermen (Table 22). The majority of these vessels are based on the island Oahu, and a few operate from the island of Maui. The boats exclusively fishing the Mau Zone (19% indicated above) have their operations based on the island of Kauai. Applying Meyer's ratios on a 29 vessel fleet (1986 conditions) would result in the following approximations: 6 boats fishing the Mau Zone and 23 boats fishing the Ho'omalu Zone. Of these 23 vessels, 5 would fish part time for bottomfish and 18 would be full-time operators.

Table 22. Fleet's estimated percentages of full-time and part-time bottomfish fishermen in areas considered the Mau Zone and Ho'omalu Zone.

Ho'omalu Zone (N=22 boats)		Mau Zone (N=5 boats)	
Full-time	23%	Full-time	Unknown
Part-time	77%	Part-time	Unknown

(Source: Meyer (1987). Based on estimated fleet size of 27 boats.)

No significant economic impact on active vessels, or the total number of boats active in the fleet, is expected to occur under the proposed rules. In the years immediately following the amendment, the number of qualifying vessels fishing in the Ho'omalu zone is estimated to drop from 23 (above) to 21 boats (see Sections 6.1 and 8.4), a reduction of approximately only 2 boats. It is unknown if these boats would be full time or part time, or even in the fishery

when the amendment is implemented. With increasing financial returns in other local fisheries (longlining and shrimping), struggling bottomfish fishermen are giving serious consideration to entering these alternative fisheries. Therefore, any concern over excluding from the fishery's existing participants will likely be a mute point. By the time the proposed limited access program is in place, those estimated few (two) fishermen that the proposed program may exclude will very likely have already exited the fishery for other opportunities. It should also be noted that boats fishing the Mau Zone (estimated six vessels) would not be affected by this amendment.

D. Description of the projected reporting and recordkeeping requirement.

The proposed program will require all commercial bottomfishing vessels fishing in the Ho'omalu Zone to submit copies of selective documentation. The type of information required and its purpose is elaborated on in Chapter 3 and Section 10.7.

F. Relationship of proposed program to other Federal regulation

Chapter 10 elaborates on the association of the proposed program to selected applicable laws and policies.

G. Description of significant alternative to proposed program.

An extensive discussion on the consideration of specific alternative management strategies for the NWHI bottomfish fishery is presented in Chapter 7. The review includes such options as fishing quotas, size limits, season and area closures, landing limits, trip limits, crew limits, taxes and license fees. These various strategies are categorized in Chapter 8 and evaluated under criteria such as biological, social, economic, and enforceability.

10.7 Applicability of Paperwork Reduction Act

The existing permit application process established by the FMP is sufficient to accommodate the proposed action. However, this amendment requires gathering additional information from the public, and adjustments will be necessary to address the following components in the amendment: 1) applicant eligibility, 2) designation of fishing zone, 3) identify percentage of ownership interest (if multiple owners), and 4) listing of relief captains, if any. Applicant eligibility would be established by submitting, with the permit application, documentation of commercial fishing experience in the NWHI bottomfish fishery prior to August 7, 1985. For owners of two or more eligible vessels, evidence would also be required to prove that each boat landed NWHI bottomfish in 1986 and 1987. Documentation would be issued by the State in the form of a notarized copy of a State catch report. This information is presently available, and no additional burden for data collection is required. The remaining adjustments would be achieved by modifying the existing permit application form. A revised permit application form is presented in Appendix B.

The present bottomfishing permit has a condition stating the permit may be revoked if required by management measures established for the fishery. This clause would be exercised under the amendment. The number of fishermen who will apply for a fishing permit under the amendment is unknown, but if only eligible fishermen presently participating in the fishery reapply, there would be a net reduction in permits and future applicants.

Because the amendment is designed to lower the number of active fishermen, the Council believes this amendment will, in the long run, reduce the burden of Federal paperwork, thereby satisfying the purpose of the Paperwork Reduction Act. However, the amendment does require the submission of information previously not required under the FMP. For this reason, Amendment 2 and associated data submission regulations and forms will require clearance under the conditions of the Paperwork Reduction Act.

10.8 Native Hawaiian Fishing Rights

Unlike the continental United States, where treaties and agreements have provided formal legal ground for allocation of fishing rights to native Americans, no treaties exist in Hawaii regarding fishing rights for native Hawaiians. Traditional Hawaiian society was significantly affected in the quarter century prior to annexation of Hawaii by the United States in 1900. Formal agreements between the two governments concerning fishing rights were not incorporated into the Organic Acts relevant to Hawaii's political integration into the United States. However, there is growing concern about the manner in which Hawaii was annexed and Hawaiian land ceded to the U.S. Government. The relationship between ancient Hawaiian land and water rights and the developing commercial fisheries is presently not known.

Is there a legal basis under the MFCMA, as amended in 1976, for providing preferential access rights to native Hawaiian fishermen under the proposed limited entry program for bottomfishing resources in the Federal waters of the U.S. EEZ in the NWHI? On the basis of preliminary research, there appears to be such a basis. However, whether such a system for preferential access rights may in fact be legally established depends upon a clear set of findings that there existed and exist historical fishing practices in such a fishery in the NWHI. Also, on such a fishery, there must be dependency by native Hawaiians, a relevant cultural and social framework, and present participation--among other relevant considerations--all set forth in 16 U.S.C.A. 1853 (6) of the MFCMA.

To establish a system of preferential access rights in the limited access proposal, it is necessary to meet the MFCMA discussed above. To determine whether the MFCMA criteria can and will be met, it is necessary to undertake certain historical and archeological research on the existence of historic fishing practices, and the attendant social and cultural frameworks of native Hawaiians with respect to bottomfishing in the NWHI.

The Council has entered into a memorandum of understanding with the Office of Hawaiian Affairs to jointly do the necessary research. A research report, or its findings, may be incorporated into the bottomfish FMP and, if the results are favorable, will be the basis for development of such a system of preferential access rights to native Hawaiians.

11.0

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

50 CFR Part

Docket No.

Western Pacific Bottomfish Fisheries

AGENCY: National Marine Fisheries Service (NMFS), NOAA, Department of Commerce.

ACTION: Proposed Rule

SUMMARY: NOAA issues a proposed rule to implement a limited access program for the bottomfish fishery in certain waters of the Northwestern Hawaiian Islands (NWHI). The program would establish a control zone called the Ho'omalu Zone, in which a person must have a limited entry permit to fish, and a qualifying zone called the Mau Zone, in which a person could earn points to qualify for future eligibility for a limited entry permit. Persons who can demonstrate participation in, or substantial financial commitment to participate in the NWHI fishery, on or before August 7, 1985, would be eligible for initial permits to participate in the Ho'omalu Zone fishery. A landings requirement would be established to maintain eligibility for annual renewal of permits. No new permits to enter the fishery would be issued until stocks are sufficiently large to provide adequate catches. A point system would be established to control issuance of permits for future entry to the fishery. The Western Pacific Fishery Management Council, (Council) with the advice of an industry and government Advisory Review Board, would make recommendations to the Regional Director, Southwest Region, NMFS, regarding future entry to the fishery. The objectives of the limited access program are to reduce the risk of overfishing, reduce the level of overcapitalization in the fishery, increase stability in the fishery, and increase profitability or net return to the fishery. The Council will undertake a full evaluation of the effectiveness of the program in five years. The rule would make it a violation of Federal law to fail to report fishery data in accordance with State reporting requirements and would require vessel operators to notify the U.S. Coast Guard prior to anticipated arrival in port to unload bottomfish taken in the NWHI.

DATE: Written comments must be received on or before _____.

ADDRESSES: Comments should be sent to E. C. Fullerton, Director, Southwest Region, National Marine Fisheries Service, 300 South Ferry Street, Terminal Island, California 90731. Copies of the limited access program, the environmental assessment (EA), and the regulatory impact review/initial regulatory flexibility analysis (RIR/IRFA) may be obtained by contacting the Western Pacific Fishery Management Council, 1164 Bishop Street, Suite 1406, Honolulu, Hawaii 96813, 808-523-1368.

Comments on the collection of information requirement should be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Attention: Desk Officer for NOAA, Washington, D.C. 20503.

FOR FURTHER INFORMATION CONTACT: Svein Fougner (Chief, Fisheries Management and Analysis Branch), 213-514-6660.

SUPPLEMENTARY INFORMATION: The domestic fisheries for bottomfish in the U.S. Exclusive Economic Zone (EEZ) adjacent to the State of Hawaii are managed under the Fishery Management Plan (FMP) for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. The FMP was developed by the Council under the Magnuson Fishery Conservation and Management Act (MFCMA) and implemented August 27, 1986 (51 FR 27413, July 31, 1986).

The Council explicitly considered but did not adopt a limited access program in the FMP because further study was deemed necessary. In a separate action, the Council adopted a control date for entry into the NWHI bottomfish fishery. This date (August 7, 1985) was set to provide a potential cutoff for eligibility based on past participation in the event the Council would choose prior participation as a criterion for eligibility for permits under the program. The intended effect of the cutoff date announcement was to discourage new entry to the fishery based on speculation while further study and discussions were undertaken on whether, and if so how, access to the resource should be controlled. Such speculation frequently occurs and could have negated the effects of any limited entry program. The notice also provided current and prospective fishermen a basis for making informed investment decisions knowing that limited entry was a definite management possibility in the future.

It should be noted that the FMP, as approved, provided the option of instituting a limited entry program through the framework process rather than as an amendment. The Council chose to use the FMP amendment process because of the significance of the action. The amendment process provides greater opportunity for broad public review as well as government agency reviews. The record will be far more complete as a result and will thus provide greater guidance to other Councils that may consider limited entry for their fisheries.

The bottomfish fishery of the NWHI management subarea has grown greatly since vessels first began exploiting the resource in the 1980s. The fleet grew from 8 vessels in 1980 to 29 vessels in 1986. Landings increased substantially from only 100,000 pounds in 1981 to about 784,000 pounds in 1986. However, catch rates have dropped sharply for the most abundant and highly priced species (*opakapaka*), and fishermen have been able to maintain total revenues only by harvesting larger amounts of less abundant (*onaga*) or less valuable (*hapu'upu'u, ulua*) species. Vessels also have had to make longer and longer trips in attempts to find areas with higher catch rates and larger fish. It is estimated that the average vessel in the fishery is losing $50,000 or more per year before depreciation and taxes, in spite of this increased fishing effort in relatively lightly fished areas where catch rates have been favorable. In summary, the fishery has been overcapitalized. Although some vessels have recently left the fleet, there is far more capacity to harvest fish than there is fish to be harvested. Further, the possibility exits that

new vessels will enter the fishery despite the present overfishing of the stocks and economic prospects.

This situation was first brought to the Council's attention in 1984 when several vessel owners proposed that the Council develop a limited entry program. The Council concluded that further information and analysis was necessary and proceeded to contract for a study. In 1985, the Council established a "control date" of August 7, 1985, which could serve as a cutoff for eligibility for entry into the fishery under a future limited access program using prior participation as a criterion for initial permits. This control date was published in the Federal Register (51FR11462, April 3, 1986), and work proceeded on an assessment of limited entry alternatives. The proposed rules would implement the program supported by that assessment (Meyer, 1987).

The goal of the limited access program is to achieve a long-term balance between harvesting capacity and harvestable stocks of bottomfish in the NWHI management subarea, so that those in the fishery will make a profit while the stocks remain healthy. This would be accomplished by initially limiting the number of persons and vessels eligible to obtain permits to fish for bottomfish in a newly designated Ho'omalu Zone in the NWHI management subarea, requiring continuing participation in the fishery to maintain eligibility for renewal of permits, preventing new entry until it is demonstrated that the bottomfish stocks can support additional effort, and establishing a system by which persons can earn points for possible entry to the fishery when new entry is permitted. A section-by-section summary of the program follows:

(a) Vessel owners and captains who can demonstrate that, before August 8, 1985, they participated in, or made commitments to invest (e.g., by obtaining a loan, making an offer to buy a vessel, or having a vessel under construction) for future participation in the fishery, would be eligible to obtain permits initially. This assures that those who were in the fishery, either as owners of vessels or as captains of those vessels, will have a continuing opportunity to participate regardless of monetary or non-monetary motivations but prevents new entry until the health of the bottomfish stocks and the fishery can support additional boats. An owner with more than one vessel in the fishery in the qualifying period would be eligible for one permit for each vessel that made at least one qualifying landing of bottomfish in 1986 and 1987. A person who owns two or more vessels which made landings before August 8, 1985, but either none or only one of those vessels made a qualifying landing in 1986 and 1987, would be eligible for only one permit. The permits will be area-specific; a person with a limited entry permit may not fish for bottomfish in the Mau Zone; and a person with a permit for the Mau Zone may not fish for bottomfish in the Ho'omalu Zone.

(b) Permits would be awarded to vessel owners for specific vessels. This is to recognize that the owners are the persons who have the greatest stake in the fishery and who would be most directly affected by the program. The owners decide how to use their vessels and associated resources and should have control over the permits for the vessels.

(c) Eligible owners would have five years from the effective date of the program in which to apply for their initial permit. This is intended to provide flexibility for a vessel owner to defer obtaining a permit until the owner concludes conditions are suitable to enter the fishery. This should prevent an initial rush to participate in the fishery and further drive down stocks under the license renewal conditions.

(d) Documentation of participation would include official landing records submitted to a State or Federal agency demonstrating that the vessel made at least one landing (regardless of weight) of bottomfish from the NWHI on or before August 7, 1985. For the purposes of this section, the NWHI is the area defined in CFR 683.5(a)(1) and is that portion of the EEZ adjacent to Hawaii that is west of 161°20'W longitude.

(e) A person who can document that he was captain of a vessel that made one or more qualifying landings from the NWHI bottomfish fishery on or before August 7, 1985, and who becomes owner of a 50% or greater share of a vessel within five years of the effective date of this plan also would be eligible for an initial permit within that time frame. This is intended to recognize that these captains should have the option of entering the fishery on the normal progression from captain to owner or part-owner of a vessel. It ensures that no owners or non-owner captains of vessels that made qualifying landings before August 8, 1985, will be automatically excluded from the fishery.

(f) A vessel for which a permit has been obtained must make at least three qualifying landings from the Ho'omalu Zone in the calendar year in which the permit was issued to be eligible for permit renewal for the next year. A qualifying landing is a landing which contained at least 2,500 pounds of bottomfish from the Ho'omalu Zone or a landing totalling more than 2,500 pounds of fish from the Ho'omalu Zone, of which at least half of the fish by weight was bottomfish. This is intended to provide a performance standard for continuing eligibility. Only those who continue to fish up to a minimum level will remain in the fishery. This provision is expected to result in a gradual reduction in the fleet. Some owners will conclude that other fisheries offer better opportunities and will shift effort accordingly; others will be unable to meet the landing criterion and will be forced to withdraw from the fishery. Remaining vessel owners will have a better chance of covering costs with less risk of biological overfishing of the stocks. The choice of three landings as the minimum performance level was based on the conclusion that the fishery is intended to support those who derive a sizable portion of their fishing income from the fishery. Requiring fewer than three landings would allow occasional participants to maintain eligibility, while more than three landings could pose a hardship for those whose vessels operate in two or more fisheries, including bottomfish in the NWHI. The program includes a provision for a permit holder to apply for a waiver from the three-landing requirement when circumstances beyond the holder's control prevented the permit holder's vessel from making the requisite landings. General economic conditions or marketing difficulties will not qualify as sufficient reason for a waiver.

(g) An owner who obtains and then voluntarily surrenders a permit to the Regional Director in the first five years of the plan will have priority for a new permit when it is found the fishery can sustain new entry. This is

intended to encourage owners to withdraw from the fishery with minimal adverse impact in the long term. If successful, this step will provide better income opportunities for remaining participants and less risk of biological overfishing. If two or more owners voluntarily surrender permits and all apply to reenter at the same time, priority shall be given to the person who first surrendered his permit. A permit holder may use this option only once.

(h) New permits may be issued in the future when the Regional Director, after consulting with the Council, finds that stocks are sufficient in the Ho'omalu Zone to generate catches high enough so that total fleet revenues with the added vessel(s) will equal or exceed total fleet costs (fixed plus variable). That is, the average vessel will have to exceed the break-even level of production before additional vessels will be permitted. This is intended to allow the fishery to become economically viable for the average vessel before new vessels will be allowed to compete for the resource. The Regional Director will place a notice in the Federal Register and use other means to notify prospective participants of the opportunity to apply for a permit under this program.

(i) Eligibility for new permits will be based on a point scale for prospective participants based on prior experience in fishing for bottomfish in the Hawaiian Archipelago. A vessel owner or captain would receive two eligibility points for each year for which he can document three or more qualifying landings of bottomfish caught in the NWHI. A qualifying landing for the point system is a landing which contained at least 2,500 pounds of bottomfish from the NWHI or which contained a total of at least 2,500 pounds of fish from the NWHI, at least half of which was bottomfish. One point would be awarded to an owner or captain for each year that the vessel landed at least 6,000 pounds of bottomfish from the main Hawaiian Islands. Points may only be earned for one area in any given year. The applicant who has at least a 25% interest in a vessel and who has the highest number of points would get the first new permit issued under the program, provided that no person who voluntarily surrendered a permit wants to reenter. This is intended to give priority to those captains who have served longest in the fishery without owning a vessel and who become owners (25% or more) of vessels to be used in the fishery. Participation as a captain in the NWHI qualifies for more points than in the main Hawaiian Islands because of the familiarity gained for that area. This is important in terms of safety and knowledge about the special protected resources of the NWHI. The partial ownership requirement is set to ensure that the participant will have an ongoing stake in maintaining the viability of the fishery. If two or more persons are tied for the highest number of points and the number of permits is less than the number of applicants, the permit(s) shall be awarded by the Regional Director by a lottery system.

(j) Permits may not be sold or otherwise transferred. If a permitted vessel is sold, the seller will retain the permit. The prohibition on the sale of permits is intended to ensure that no persons will have a windfall financial benefit by virtue of eligibility for initial permits under the program and to minimize the potential for one or a few interests to acquire a virtual monopoly or oligopoly in the fishery. The Council considered using an individual fisherman's quota system but concluded that it would be impossible to agree on

cumulative bottomfish quotas or species quotas that could be allocated in such shares. The Council also preferred not to allow the cost of permits to become a significant barrier to future entry to the fishery.

(k) Notwithstanding the general prohibition on permit transfers, a permit holder may replace his permitted vessel with another vessel of up to 60 feet in length without obtaining any approvals. This is intended to allow a vessel owner to increase the size of his vessel for safety purposes. This provision recognizes that adverse sea conditions often arise in the control zone.

(l) A permit holder also may apply to the Regional Director for permission to replace his permitted vessel with another vessel of equal catching power. The Regional Director shall consult with the Council before acting on such a request. This would allow use of a vessel with greater safety or comfort but not greater catching power.

(m) A permit holder may apply to the Regional Director for permission to replace his vessel with one of greater fishing power in order to maintain fishing power comparability with other permitted vessels in the fishery. The Regional Director shall consult with the Council and shall review the application for consistency with the objectives of the limited access program before taking action on such applications.

(n) Permits may be held and renewed by partnerships or corporations. If 50% or more of their interest in the permitted vessel passes to persons other than those listed in the original application, however, the permit will lapse and be surrendered to the Regional Director. This is intended to ensure that a partnership or corporation ownership will not be used to circumvent the prohibition on sale or transfer of a permit.

(o) Designated captains and relief captains must attend a workshop on safety and endangered species concerns specific to the NWHI. The waters in the NWHI present unusual conditions which give rise to special safety concerns. In addition, there are several endangered and threatened species in the area, and special management regulations exist to protect them. The workshop is intended to minimize the risk of problems associated with these factors.

(p) The Council will establish an Advisory Review Board to assist the Council in developing recommendations for the Regional Director concerning whether and when new entry to the Ho'omalu Zone is appropriate, catching power equivalency for replacement vessels, and other matters in implementing this program. The Board will consist of nine persons, including two limited entry permit holders, two persons fishing for bottomfish in the Mau Zone or around the main Hawaiian Islands, one person engaged in marketing or processing of NWHI bottomfish, two technical State fishery staff, and two NMFS staff. The technical staff shall include at least one biologist and one economist. The term of nongovernment members is limited to five years, and initial terms may be staggered. The intent of the panel is to provide both technical information and practical fishery information in carrying out the program. The composition of the panel is intended to ensure full representation of fishing interests and technical experts on the fishery.

(q) The program provides an appeal mechanism by which persons can request higher level review of a decision by the Regional Director. The Assistant Administrator for Fisheries would decide such appeals.

(r) The Council is aware of the potential that the limited access program will not have the intended effects. This is a new approach, and the responses of fishermen cannot be predicted with certainty. It is quite possible that program changes will be needed as experience is gained in the program. The effectiveness of the program will be assessed in the annual review of the fishery called for under the FMP. In addition, the Council will complete a special evaluation of the program after the initial five-year grace period during which historic participation is an automatic eligibility criterion. At that time, the Council and the NMFS will know how many persons are eligible for permits and can better predict future participation and problems.

s) The proposed rule contains two provisions intended to facilitate monitoring of the fishery for future evaluation of its effectiveness and administration of the program. The first provision is it would be a violation of Federal law to fail to report landings in accordance with State fishery reporting requirements. This will not add to the reporting burden but should strengthen the effeciveness of State reporting requirements. State-collected landings data will be important to determine changes in the fishery under this program and to assess whether the program is having the intended effects. The second provision is vessel operators be required to notify the U.S. Coast Guard in advance of the anticipated arrival in port to unload bottomfish taken in the NWHI. This will support determination of participation by vessels in the fishery and occasional inspection of the catch to collect biological data with the cooperation of the vessel operators.

Nothing in the limited entry program is intended to prevent or limit the authority of the Council to propose and the Secretary to institute additional conservation and management measures necessary to protect the productivity of the bottomfish stocks of the NWHI. It is expected, however, that such measures will be far more likely to succeed after the limited entry program is in effect. In addition, it is expected that, with limited entry in effect, the participants in the fishery will ultimately have greater flexibility in their selection of fishing strategies to maximize economic returns or achieve non-monetary objectives with a reduced regulatory burden.

In developing this program, the Council considered the question of whether to make special provision for native Hawaiian fishing rights. No recommendations or proposals are made at this time. The Council is continuing to research this issue with the Native Hawaiian Legal Corporation and the Office of Hawaiian Affairs.

The proposed program will add slightly to the information collection burden under the FMP. Fishermen in the NWHI already are required to obtain permits under the current management regulations. Those who may be eligible for permits under the limited access program will have to provide additional information to document their prior participation or their financial commitment for anticipated participation in the fishery. This does not entail new catch or effort reporting requirements. However, the applicant will have

to provide either copies of historic catch records filed with a State or Federal agency or a statement from a State or Federal agency confirming that the applicant was an owner or captain of a vessel that made qualifying landings from the fishery during the period in question.

The proposed rule does not require that catch, effort or fishery operations data be submitted to the Secretary of Commerce (Secretary) under this program. The FMP calls for an annual report to be prepared for Council consideration. The State and Territory governments and the NMFS provide information for this report, which is used to consider the need for changes in management of the fishery. The annual report includes an assessment of economic conditions as well as the status of the stocks. It is anticipated that existing State and Federal reporting requirements will be sufficient to make the determinations required under the limited access program. The provision making it a violation of Federal law to fail to report in conformance with State laws and regulations governing reporting landings should support State reporting requirements.

CLASSIFICATION

Section 304(a)(1)(D)(ii) of the MFCMA, as amended by Pub. L. 99-659, requires the Secretary to publish regulations proposed by a Council within 15 days of receipt of any amendment to an FMP. At this time, the Secretary has not determined whether the FMP amendment that these rules would implement is consistent with the MFCMA National Standards, other provisions of the MFCMA, and other applicable law. The Secretary, in making that determination, will take into account the data, view points, and comments received during the comment period.

The Council prepared an environmental assessment as part of the FMP amendment and concluded that there will be no significant impact on the environment as a result of this rule.

The Administrator of NOAA determined that this proposed rule is not a "major rule" requiring a regulatory impact analysis under Executive Order 12291. The proposed action will not have a cumulative effect on the economy of $100 million or more nor will it result in a major increase in costs to consumers, industries, government agencies, or geographical regions. No significant adverse impacts are anticipated on competition, employment, investments, productivity, innovation, or competetiveness of U.S.-based enterprises.

The Council prepared a regulatory impact review as part of its amendment and concluded that the proposed action will have a long term positive impact on the fishery and on related processing and marketing sectors. Preventing new entry at this time will prevent additional effort which would drive catch rates down to even lower levels than at present. The performance standard is expected to be sufficient to ensure that those dependent on the fishery will be able to maintain their participation without putting excessive pressure on the stocks, while those not dependent on the fishery will be less likely to maintain eligibility for future participation. The measure allowing those initially eligible to obtain permits to defer applying for permits for up to five years is expected to allow such persons flexibility to participate in other fisheries

without losing eligibility; this would further reduce pressure on the stocks while giving persons in the fishery a better chance to cover costs. The measure allowing voluntary surrender of a permit with priority for later entry to the fishery is expected to encourage some producers to exit from the fishery. Again, this will reduce pressure on the stocks and remaining participants should achieve better returns. The fishery accounted for total catch of 784,000 pounds valued at $1.9 million in 1986. Without the proposed program, the fishery is expected to decline to a level substantially below the maximum sustainable yield (MSY) level (600,000 pounds for portion of the NWHI within the range for deliveries for the fresh fish market) and ex-vessel revenue would likely be less than $1 million per year. With the limited entry program, the fishery is expected to achieve production of 600,000 pounds per year (the MSY) valued at $1.4 million. In addition, the average vessel is expected to be able to cover all costs of operation, although some vessels will make more and some less. Further, deliveries of fish to markets are expected to be more stable and level throughout the year, which will benefit both marketers and consumers. Finally, although there may be a one- time increase in administrative costs to implement the program initially, these costs will be reduced over time as the size of the harvest sector is reduced and fishery patterns become more stable.

This proposed rule is exempt from the review procedures of Executive Order 12291, Section 8(a)(2). Deadlines imposed under the MFCMA as amended by Pub. L. 99-659, require the Secretary to publish this rule 15 days after its receipt. The proposed rule is being reported to the Director, Office of Management and Budget (OMB), with an explanation of why it is not possible to follow procedures of the order.

The General Counsel of the Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, will not have a significant economic impact on a substantial number of small businesses. No person who participated in the fishery on or before the control date will be forced to exit the fishery. The program will provide an opportunity for fishermen to make their own decisions concerning whether to remain in the fishery. The reporting burden will be somewhat increased to obtain information needed to decide whether applicants are eligible for permits, but the added burden is slight. Therefore, a formal Regulatory Flexibility Analysis was not prepared.

This proposed rule contains a collection of information requirements subject to the Paperwork Reduction Act. Permit application procedures will not change appreciably from those now in place, but applicants will have to obtain and submit certification of records of past participation or documentation of commitments intended to lead to future participation in the fishery in past years. In addition, it is proposed that permit holders be required to report in advance their anticipated arrival in a port to unload fish taken in the NWHI. Further, it is proposed that it be a violation of Federal law to fail to report fishery data in accordance with State reporting requirements. The new information collection request has been submitted to the OMB for clearance. Reporting requirements now in force are authorized by OMB number 0648-0097.

The Council has determined that the measures established in this amendment are consistent to the maximum extent practicable with the approved Coastal Zone Management Program in Hawaii. A letter requesting the State of Hawaii's concurrence was forwarded by the Council.

List of Subjects in 50 CFR Part 683

Fisheries, reporting, and recordkeeping requirements.

Dated:

For the reasons stated in the preamble, 50 CFR Part 683 is proposed to be amended as follows:

PART 683 - [AMENDED]

1. The authority citation for 50 CFR Part 683 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq. unless otherwise noted.

2. In Section 683.2, a new definition for qualifying landing is added to read as follows:

Section 683.2 Definitions

* * * * *

Qualifying landing means a landing that meets a standard required for permit eligibility under Section 683.25, as follows:

(a) Initial permit eligibility. (i) a qualifying landing for initial permit eligibility under 683.25(b)(1) and (3) is a landing that contained bottomfish from the NWHI, regardless of amount, and which was made before August 8, 1985;

(ii) a qualifying landing for 1986 and 1987 under 683.25 (b)(2) is a landing which contained at least 2,500 pounds of bottomfish from the NWHI or a landing of at least 2,500 pounds of fish from the NWHI, of which at least 50 percent by weight was bottomfish;

(b) Permit renewal - a qualifying landing for permit renewal under 683.25(e) is a landing which contained 2,500 pounds of bottomfish from the NWHI or a landing of at least 2,500 pounds of fish from the NWHI, of which at least 50 percent by weight was bottomfish.

(c) New entry eligibility points - a qualifying landing for eligibility points under 683.25(j) is any landing of bottomfish from the NWHI, regardless of weight, if made prior to August 8, 1985; or a landing of at least 2,500 pounds of bottomfish from the NWHI, or a landing of at least 2,500 pounds of fish from the NWHI, of which at least 50 percent by weight was bottomfish.

3. In Section 683.5, paragraph (a)(2) is revised to add two subareas as follows:

Section 683.5 Management subareas

* * * * *

(2) * * * *

(i) Ho'omalu Zone means that portion of the EEZ around the NWHI west of 165°W longitude.

(ii) Mau Zone means that portion of the EEZ around the NWHI between 161°20' and 165°W longitude.

* * * *

4. In Section 683.6, paragraph (k) is redesignated (m) and new paragraphs (k) and (l) are added as follows:

Section 683.6 General prohibitions

* * * * *

(k) Fish for bottomfish in the Ho'omalu Zone without a limited access permit issued under Section 683.25;

(l) Falsify or fail to make and/or file any and all reports of bottomfish landings, containing all data and in the exact manner, required by the applicable State law as specified in Section 683.25 provided that the person is required to do so by the applicable State law;

5. A new Section 683.10 is added as follows:

683.10 Appeals of administrative action

(a) Except as provided in Subpart D of 15 CFR 904, any applicant for a permit or permit holder may appeal the granting, denial, conditioning, or suspension of their permit or a permit affecting their interests to the Assistant Administrator for Fisheries, NOAA. In order to be considered by the Assistant Administrator, such appeal must be in writing, must state the action(s) appealed, and the reasons therefor, and must be submitted within 30 days of the action(s) by the Regional Director. The appellant may request an informal hearing on the appeal.

(b) Upon receipt of an appeal authorized by this section, the Assistant Administrator will notify the permit applicant, or permit holder as appropriate, and will request such additional information and in such form as will allow action upon the appeal. Upon receipt of sufficient information, the Assistant Administrator will decide the appeal in accordance with the criteria set forth in Section 683 and the amendment to the bottomfish FMP, as appropriate, based upon information relative to the application on file at the NMFS and the Western Pacific Fishery Management Council and any additional information, the summary record kept of any hearing and the hearing officer's recommended decision, if any, as provided in Section 3 of this section, and such other considerations as deemed appropriate. The Assistant Administrator will notify all interested persons of the decision, and the reasons therefor, in writing, normally within 30 days of the receipt of sufficient information, unless additional time is needed for a hearing.

(c) If a hearing is requested or if the Assistant Administrator determines that one is appropriate, the Assistant Administrator may grant an informal hearing before a hearing officer designated for that purpose after first giving notice of the time, place, and subject matter of the hearing in the FEDERAL REGISTER. Such a hearing shall normally be held no later than 30 days following publication of the notice in the FEDERAL REGISTER unless the hearing officer extends the time for reasons deemed equitable. The appellant, the applicant (if different), and, at the discretion of the hearing officer, other interested persons, may appear personally or be represented by counsel at the hearing and submit information and present arguments as determined appropriate by the hearing officer. Within 30 days of the last day of the hearing, the hearing officer shall recommend in writing a decision to the Assistant Administrator.

(d) The Assistant Administrator may adopt the hearing officer's recommended decision, in whole or in part, or may reject or modify it. In any event, the Assistant Administrator will notify interested persons of the decision, and the reason(s) therefor, in writing within 30 days of receipt of the hearing officer's recommended decision. The Assistant Administrator's action shall constitute final action for the agency for the purposes of the Administrative Procedures Act.

(e) Any time limit prescribed in this section may be extended for a period not to exceed 30 days by the Assistant Administrator for good cause, either upon his or her own motion or upon written request from the appellant or applicant stating the reason(s) therefor.

6. A new Section 683.11 is added as follows:

683.11 Reports

Any person who is required to do so by the applicable State law shall make and/or file any and all reports of bottomfish landings, containing all data and in the exact manner, required by the applicable State law.

7. In Section 683.21, paragraph (a) is revised and a new paragraph (f) is added to read as follows:

683.21 Permit requirements for the NWHI

(a) Permit areas.

(1) The owner of any vessel being used to fish for bottomfish in the Mau Zone must have a permit issued under this section for that vessel.

(2) The owner of any vessel fishing for bottomfish in the Ho'omalu Zone must have a permit issued under Section 683.25 for that vessel.

(3) The owner of any vessel fishing for seamount groundfish in the fishery management area must have a permit issued under this section for that vessel.

(4) No vessel may be covered by a permit for both the Ho'omalu Zone and the Mau Zone at the same time.

* * * * *

(f) Expiration. Permits issued under this section expire on December 31 of the year covered by the permit.

8. Section 683.25 is renumbered 683.26, and a new 683.25 is added to read as follows:

683.25 Limited access management program

(a) Limited access permits. General requirements.

(1) The owner of any vessel engaged in fishing for bottomfish in the Ho'omalu Zone must have a permit issued under this section.

(2) Permits issued under this section shall expire on December 31 of the year covered by the permit.

(3) Each application for a permit must be submitted to the Regional Director by the vessel owner at least 30 days before the date on which the applicant wants the permit to be effective.

(4) Each application must be submitted on the form used to apply for a permit under 683.21(b) and a supplementary information sheet to be provided by the Regional Director. Each application must be signed by the vessel owner and must contain, in addition to the information listed in 683.21(b)(2), the following information:

(i) The qualification criterion that the applicant believes he or she meets for issuance of a limited access permit; and

(ii) Copies of landings receipts or other documentation with a certification from a State or Federal agency that this information is accurate to demonstrate participation in the NWHI bottomfish fishery; or

(iii) Notarized copies of loan documents or other documents that would demonstrate financial commitments before August 8, 1985, to enter the NWHI bottomfish fishery; or

(iv) Written evidence indicating that an offer was made to purchase a vessel or that a vessel was under construction, by August 7, 1985, and that the vessel was to be used in the NWHI bottomfish fishery.

If the application is filed by a partnership or corporation, the application must identify the names of the owners and their respective percentage of ownership of the partnership or corporation.

(5) Protected species seminar. Each designated captain and relief captain must participate in a seminar conducted by the NMFS and U.S. Fish and Wildlife Service to ensure familiarity with protected species laws and regulations applicable to the NWHI and the species those laws and regulations are designed to protect.

(6) Sale or transfer of permits to new owners.

(i) A vessel permit may not be sold or otherwise transferred to a new owner.

(ii) A permit or permits may be held by a partnership or corporation. If 50% or more of the ownership of the vessel passes to persons other than those listed in the original application, the permit will lapse and must be surrendered to the Regional Director.

(7) Transfer of permits to new vessels.

(i) An owner of a permitted vessel may without limitation transfer his permit to another vessel owned by him provided that the replacement vessel does not exceed 60 feet in length and that the replacement vessel is put into service within 12 months after the owner declares to the Regional Director the intent to make the transfer of the permit.

(ii) An owner of a permitted vessel may apply to the Regional Director for approval to use the permit for a replacement vessel greater than 60 feet in length. The Regional Director may allow this change upon determining, after consultation with the Council and considering the objectives of the limited access program, that the replacement vessel has equal catching power as the original vessel, or that the replacement vessel has catching power that is comparable to the rest of the vessels holding permits for the fishery, and that the change is not inconsistent with the objectives of the program.

(iii) The Regional Director shall consider vessel length, range, hold capacity, gear limitations, and other appropriate factors in making determinations of catching power equivalency and comparability of the catching power of vessels in the fishery.

(b) Supplementary requirements for initial permits. A permit for a vessel to be used for fishing for bottomfish in the Ho'omalu Zone may be issued to:

(1) Any owner who can document that a vessel owned by him made one or more qualifying landings of bottomfish from the NWHI before August 8, 1985.

(2) Any owner of two or more vessels that made at least one qualifying landing under (1), or such owners may obtain a permit for each such vessel that made at least one qualifying landing of bottomfish under (1) and also in both 1986 and 1987.

(3) Any person who can document that by August 7, 1985, he or she had incurred substantial expenditures for or had received written approval of a loan to purchase or construct a vessel to be used in the NWHI bottomfish fishery.

(4) Any person who can document that by August 7, 1985, he or she made an offer to purchase a vessel for the NWHI bottomfish fishery or had such a vessel under construction.

(5) Any person who can document that he or she was captain of a vessel that made at least one qualifying landing of bottomfish from the NWHI before August 8, 1985, and who becomes an owner of 50% or more interest in a vessel within five years of the effective date of this program.

(6) Any person who qualifies for issuance of a permit under paragraph (j) of this section.

An application for a permit under this section must be filed within five years of the effective date of this program.

(b) Supplementary requirements for permit renewal.

(1) A permit will be eligible for renewal if the vessel covered by the permit makes three or more qualifying landings during the permit year.

(2) The owner of a permitted vessel that did not make three or more qualifying landings of bottomfish in a year may apply to the Regional Director for waiver of the landing requirement. If the Regional Director finds that failure to make three landings was due to circumstances beyond the owner's control, he may renew the permit. A waiver may not be granted if the failure to make three landings was due to general economic conditions or market conditions such that the vessel operations would not be profitable.

(c) Supplementary requirements for new entry permits. The Regional Director may issue new vessel permits under this part when the Regional Director has determined, in consultation with the Council, that bottomfish stocks in the Ho'omalu Zone are able to support additional fishing effort. This shall be established by determining that the total estimated annual revenue to the fleet exceeds the total estimated annual fixed and variable costs to the fleet in the Ho'omalu Zone by an amount at least equal to the average cost of a vessel year. This determination shall be made and published annually in association with the annual report required under Section 683.24 of this part.

(1) Eligibility

(i) When the Regional Director has determined that new permits may be issued, they shall be issued to applicants based upon eligibility determined as follows:

(A) Two points shall be assigned for each year in which the applicant was owner or captain of a vessel which made three or more landings of bottomfish from the NWHI.

(B) One point shall be assigned for each year in which the applicant was owner or captain of a vessel that landed at least 6,000 pounds of bottomfish from the main Hawaiian Islands.

(C) Points will be assigned only under (A) or under (B) for any one year.

(D) Points will be assigned for every year for which the requisite landings can be documented.

(ii) An applicant must own at least a 25% share in the vessel that the permit would cover, and only one permit will be assigned to any vessel.

(iii) New permits shall be awarded to applicants in descending order starting with the applicant with the largest number of points. If two or more persons have an equal number of points, and there are insufficient new permits for all such applicants, the new permits shall be awarded by the Regional Director through a lottery.

(iv) Notwithstanding (iii) above, a person who originally qualifies for and obtains a permit under 683.25(a) and who voluntarily surrenders that permit to the Regional Director within the first five years of this program shall have priority over applicants under the point scale system for a new permit under this section. If two or more persons qualify under this provision, the person surrendering his permit at the earliest date will have first priority. If two or more such persons are equally qualified under the date of surrender criterion, the permit shall be awarded by the Regional Director by a lottery. A permit holder may qualify for this provision only one time.

(v) The Regional Director shall place a notice in the FEDERAL REGISTER and shall use other means to notify prospective applicants of the opportunity to file applications for new permits under this program.

9. A new part 683.27 is added as follows:

Section 683.27 Notification of landings

The operator of a fishing vessel that has taken bottomfish in the NWHI shall contact the U.S. Coast Guard, by radio or otherwise, at the 14th District, Honolulu, Hawaii (Telex: 392401); Pacific Area, San Francisco, California (Telex: 330427); or 17th District, Juneau, Alaska (Telex: 45305), at least 24 hours before landing, and report the port and the approximate date and time at which the bottomfish will be landed.

10. A new part 683.28 is added as follows:

Section 683.28 Native Hawaiian fishing rights (reserved)

12.0 REFERENCES

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13.0 APPENDIX A

DATE: March 27, 1986

TO: Bottom Fish Planning Team Members

FROM: Steve Ralston

SUBJECT: Estimating productivity and MSY of Hawaii's bottom fishery

One of the most pressing items before the team, at least from my perspective, is to provide guidance and recommendations to the Council concerning how much activity the local fishery can support. Clearly, if a limited access management program is adopted, we need to know something about how many people the fishery can support. The first step in answering this question is to develop what may be considered a reasonable estimate standardized bottom fish productivity (i.e., sustained yield per unit area of habitat).

At the present time there are 3 sources for this kind of estimate. The first is provided in the Ralston-Polovina paper which appeared in Fishery Bulletin (1982, vol. 80(3):435-448). Based upon a total biomass surplus-production model using HDAR data collected over the period 1959-1978, an attempt was made to estimate MSY for 4 separate multispecies "stocks" within the main Hawaiian Islands. Results were inconclusive for the Big Island stock and for the Kauai-Niihau-Kaula Rock stock. Significant results were obtained, however, for the Oahu and Molokai-Lanai-Maui-Kahoolawe (MLMK) stocks. The results were as follows:

	MSY	Available Habitat	Productivity
Oahu	15,700 kg/yr	150 nmi 100-fathom isobath	105 kg/yr/nmi
MLMK	106,000 "	390 "	272 "

There is one major problem with the above estimates. Because the HDAR catch report data set does not include recreational landings, we must consider the above estimates of bottom fish productivity to represent lower bounds of potential production. This is perhaps an especially significant problem for the Oahu estimate, due to the proximity of Honolulu and its high density urban environment. For this reason, I believe it is reasonable to discount the figure obtained for Oahu.

The second source of bottom fish productivity estimates is derived from the resource assessment survey of the Marina Archipelago undertaken by the Honolulu Laboratory of NMFS (RAIMO Program, 1982-1985). The analytical approach used in this study was entirely different from the Ralston-Polovina analysis. In this case, the Beverton-Holt dynamic pool model was applied to an array of biological data gathered on a variety of individual species, including estimates of growth, mortality, abundance, and several other significant assessment parameters. The results of this work are summarized in the appended tables. Twenty-two different island communities were treated individually, each composed of 7 different species and a catchall "others" for the

unaccounted for species which remained. Close examination of species composition, catch rates, and other factors showed that these 22 localities were representative of 3 main types of communities based on habitat similarity: (a) the southern limestone islands, (b) the northern basaltic islands, and (c) the offshore seamounts of the Western Marianas Ridge. After the numbers were fully crunched the following results emerged.

Island Type	Productivity
Limestone Islands	228.5 kg/yr/nmi
Basalt Islands	212.9 "
Seamounts	264.4 "
-Average-	222.4 "

The figures compare remarkably well with those obtained by entirely different methods at the MLK bank in Hawaii. The data suggest further that the Marianas are perhaps not as productive as Hawaii when it comes to bottom fish. The preceding analysis is now in press in Fishery Bulletin (Polovina and Ralston).

The last source of information on this subject comes from the work Jeff Polovina did with the ecosystem model at French Frigate Shoals as part of the Northwestern Hawaiian Islands Resource Investigations (Coral Reefs, 1984, Vol. 3:1-11). Once again, based on an entirely different type of approach, in which biomass components in a model ecosystem were balanced to reflect assumed predator limitation, Jeff estimated that the potential fisheries productivity of the bottom fish component at FFS amounted to 286 kg/yr/nmi of 100 fathom isobath.

There is surprising similarity in all of these estimates, which range from 213-286 kg/yr/nmi (coefficient of variation = 12%). The problem we are faced with is to pick one to proceed with. I suggest we use 286 kg/yr/nmi as our first choice. The reasons for this are:

(1) If we are going to err at this time we should be careful not to be so overly conservative that we alienate industry and jeopardize our interactions in the future.

(2) The estimate of productivity from the heavily fished MLMK bank (272 kg/yr/nmi) is similar and appears to be reasonably reliable. Remember that this figure does not include "recreational catch."

Once an estimate of bottom fish productivity is assumed (286 kg/yr/nmi) it is possible to estimate the potential landings from each of the island areas as shown in the following table. All figures given for the total amount of bottom fish habitat at each island area were provided by the Council's research staff.

Main Hawaiian Islands

Island	Habitat	MSY
Hawaii	263 nmi 100 fathom isobath	75.2 MT
MLMK	415 "	118.7 "
Oahu	137 "	39.2 "
Kauai	100 "	28.6 "
Niihau	60 "	17.2 "
Kaula Rock	22 "	6.3 "
TOTAL	**997** "	**285.2 MT**

NORTHWESTERN HAWAIIAN ISLANDS -- (subdivided into "Kauai access," primary fresh, and potential frozen zones).

Nichoa	122	"	34.9 "
Necker	154	"	44.0 "
FFS	67	"	19.2 "
Brooks	68	"	19.4 "
St. Rogatian	41	"	11.7 "
Intervening Bank	18	"	5.1 "
Gardner	123	"	35.2 "
Raita	59	"	16.9 "
Maro	93	"	26.6 "
Laysan	51	"	14.6 "
Northampton	53	"	15.2 "
Pioneer	45	"	12.9 "
Lisianski	75	"	21.5 "
Intervening Bank	35	"	10.0 "
Salmon Bank	27	"	7.7 "
Pearl & Hermes	62	"	17.7 "
Gambia Shoal	8	"	2.3 "
Ladd Seamount	29	"	8.3 "
Midway	44	"	12.6 "
Nero Seamount	21	"	6.0 "
Kure	36	"	10.3 "

Kauai Access Zone	78.9 MT
Primary Fresh Zone	198.3 MT
Potential Frozen Zone	74.9 MT

NWHI TOTAL	**1231**	"	**352.1 MT**
GRAND TOTAL	**2228**	"	**637.3 MT**

As you can tell by the way these figures were arrived at, they must be considered a first approximation to the potential sustainable yield from the Hawaiian bottom fishery. I do believe they provide us with a basis to begin thinking about implementing a limited access management program in the Northwestern Hawaiian Islands. It is also worth pointing out that, according

to the best estimates available, the 1984 landings of bottomfish from the Main Hawaiian Islands (commercial and recreational) were 354 MT and those from the NWHI were 265 MT. The total estimated landings were 619 MT. The next problem is the economic issue of optimum yield. Another problem is whether species composition and seasonality will affect these optimality decisions.

OMB Control No.
648-0097

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

FISHING VESSEL PERMIT APPLICATION FOR LIMITED ACCESS PROGRAM FOR BOTTOMFISH IN THE NORTHWESTERN HAWAIIAN ISLANDS

Date Application Received

Permit Number Assigned

(APPLICATION INFORMATION - PLEASE PRINT)

(1) Name of Applicant (Last, First, Middle)

(2) Name of Vessel Owner (Last, First, Middle) | Telephone Number

(3) Mailing Address of Vessel Owner | City and State | Zip Code

(4) Operator's Name (Last, First, Middle) | Telephone Number

(5) Mailing Address of Operator | City and State | Zip Code

(PERMIT INFORMATION - PLEASE PRINT)

(6) Type of Application:
a. New Permit - ☐
b. Renewal Permit - ☐

(7) Prior Permit Number:

(8) Expiration Date of Permit:

(VESSEL INFORMATION - PLEASE PRINT)

(9) Vessel Name: | (10) Official Number: | (11) Radio Call Sign: | (12) Home Port:

(13) Gross Registered Tons: | (14) Registered Length of Vessel: | (15) Beam of Vessel: | (16) Fuel Capacity:

(17) Average Cruising Speed: | (18) Maximum Range of Vessel: | (19) Horsepower: | (20) Age of Vessel:

(21) Purchase Date of Vessel:

(22) Purchase Price of Vessel:

(FISHING INFORMATION - PLEASE PRINT)

(23) Vessel Fish Hold Capacity: (IN TONS)

(24) Type of Refrigeration Capacity: (IN TONS)
a. Ice - ____
b. On Board Ice Plant - ____
c. Plate Freeze ____
d. Blast Freeze ____
e. Other (specify): - ____

(25) Type and Number of Fishing Gear:
a. Handline - ____
b. Traps - ____
c. Bottom longline - ____
d. Other (specify):- ____ ____

I have attached the documentation necessary to demonstrate eligibility under the limited access criteria and will attend an endangered species seminar prior to fishing under this permit.

APPLICANT'S SIGNATURE: _____ DATE: _____
(owner/operator)

SUBMIT THIS COPY TO THE REGIONAL DIRECTOR

OMB CONTROL NO.

LIMITED ACCESS PERMIT APPLICATION - SUPPLEMENTAL INFORMATION

NAME _____

VESSEL _____

Basis for application (documentation must be attached):

NEW PERMIT BASED ON HISTORIC PARTICIPATION CRITERIA

_____ Owner of vessel which made landings of NWHI bottomfish prior to 8/7/85; if permits are being requested for two or more vessels, documentation must show that each vessel made at least one landing of NWHI bottomfish in 1986

_____ Previously non-owner skipper of vessel which landed NWHI bottomfish prior to 8/7/85 and now owner (50% or greater interest) of vessel for bottomfish fishery

_____ Incurred substantial expenditure, or received written commitment for loan, prior to 8/7/85, to obtain vessel for bottomfish fishery

_____ Owner of vessel which qualified for initial permit and for which the permit was voluntarily surrendered by the owner to the Regional Director

NEW PERMIT BASED ON ELIGIBILITY POINT SYSTEM

_____ Owner of 25% or greater interest in a vessel which may qualify on the basis of points earned through landings of bottomfish from the NWHI or Main Hawaiian Islands

RENEWAL OF EXISTING PERMIT

_____ Owner of vessel which qualifies for permit renewal by making at least three (3) landings of bottomfish taken in the Ho'omalu Zone in the past year

IF THE VESSEL OWNER IS A PARTNERSHIP OR CORPORATION, THE DOCUMENTATION MUST INCLUDE A LIST OF PARTNERS/SHAREHOLDERS AND THE RELATIVE OWNERSHIP SHARE OF EACH

IF THE VESSEL FOR WHICH THE APPLICATION IS BEING FILED IS A REPLACEMENT FOR A VESSEL WHICH WOULD HAVE QUALIFIED UNDER THE CRITERIA OF THE PROGRAM, DOCUMENTATION MUST INCLUDE INFORMATION ON THE ORIGINAL VESSEL AS IN THE "VESSEL INFORMATION" BLOCK ON THE APPLICATION FORM

NATIONAL MARINE FISHERIES SERVICE
HONOLULU LABORATORY
2570 DOLE STREET
HONOLULU, HAWAII 96822-2396

March 1987

AN ASSESSMENT AND DESCRIPTION OF THE STATUS OF BOTTOM FISH STOCKS IN HAWAII

Stephen Ralston and **Kurt E. Kawamoto**
Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service, NOAA
Honolulu, Hawaii 96822-2396

NOT FOR PUBLICATION

ADMINISTRATIVE REPORT H-87-7

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Southwest Fisheries Center Administrative Report H-87-7

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ABSTRACT

The Honolulu wholesale market for bottom fish was studied to assess the condition of the fishery and the status of the stocks. Six species comprise the preponderance of landings passing through this market (opakapaka, onaga, ehu, uku, hapuupuu, and butaguchi) and nearly all lots of bottom fish are of Hawaiian origin (89.6-96.9% between 1984 and 1986).

Total landings indicate the importance of opakapaka to the Hawaiian deep-sea handline fishery, although catches from the Northwestern Hawaiian Islands (NWHI) have declined 16.5% over the last 3 years. A trend of substitution by onaga is increasingly evident in the fishery. Catches of onaga, ehu, hapuupuu, and butaguchi from the NWHI have all increased substantially from 1984 to 1986. In contrast, bottom fish landings from the main Hawaiian Islands (MHI) have remained very stable (coefficient of variation = 3.0%).

Size structured yield-per-recruit analyses demonstrate that the MHI fisheries for opakapaka, ehu, and uku are moderately to severely growth-overfished. These species may benefit from minimum size restrictions. In contrast, an increased harvest of onaga in the MHI is suggested while the fishery for hapuupuu is close to optimal.

In the NWHI there is no evidence of growth-overfishing for any of the five species analyzed (opakapaka, onaga, ehu, hapuupuu, and butaguchi). This is likely due to the fishery being in a state of disequilibrium, the result of increasing fishing effort (30% increase in 3 years) and major changes in fishing grounds. In 1986 the fishery for bottom fish in the NWHI shifted almost 300 nmi to the northwest as more distant stocks were more heavily exploited.

Current harvest levels in the MHI are believed near maximum sustainable yield, although much better information concerning the recreational and unaccounted for commercial catch of these fishes is necessary before a more accurate assessment can be made. In the NWHI landings are presently in excess of the best available estimate of MSY as bottom fish stocks are "fished up." It is recommended that better data on the location of bottom fish harvests in the NWHI be obtained for future assessment work.

INTRODUCTION

As used by the fishermen of Hawaii and other island locations in the tropical Pacific, the term bottom fish refers to the complex of species typically caught with deep-sea handline gear. Most are snappers (lutjanids) and related forms (i.e., lethrinids and emmelichthyids), although groupers (epinepheline serranids), several species of jacks (carangids), and at least one scorpionfish (scorpaenid) are included in the fish community that is harvested by hook-and-line fishing gear in offshore waters 60-300 m deep. Bottom fish are usually found in habitats characterized by hard bottom of high structural complexity, restricting their accessibility to trawl and longline gears. Historically the Hawaiian deep-sea handline fishery for bottom fish has been one of the most important in the State, serving both commercial and recreational sectors of the community. A number of previous workers have studied and described aspects of the biology (Ralston and Polovina 1982; Ralston and Miyamoto 1983; Ralston 1984; Ralston, Gooding, and Ludwig 1986; Polovina 1987) and economics (Hau 1984; Pooley 1987) of this fishery (see also Hawaii Department of Land and Natural Resources 1979; Ralston 1979, 1982).

In 1986 a fishery management plan (FMP) was implemented by the Western Pacific Regional Fishery Management Council (Council) for the bottom fish and seamount groundfish fisheries of the western Pacific region (Hawaii, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands). The plan was prepared under the guidelines of the Magnuson Fishery Conservation and Management Act of 1976 and is intended to result in the management of the bottom fish fishery so that optimal yields are realized.

The bottom fish FMP stipulates that every year a monitoring team appointed by the Council will assess the biological and economic conditions prevailing in the fishery and will prepare a report that presents its findings to the Council. If deemed necessary the team will suggest alternatives for corrective management action. The work presented here, by examining a variety of biological factors and fishery performance indicators that have been gleaned from a market sampling program, represents a biological contribution to the monitoring team's annual assessment of the fishery. Particular attention is paid to the size structure of certain key species in the Hawaiian fishery. This specific type of analysis has been used previously (Ralston and Kawamoto 1985) and is described in detail elsewhere (Ralston, Tagami, and Shiota 1986).

METHODS

The data used here were derived from a sampling program designed to monitor the landings of commercial fishermen at the centralized wholesale fish market in Honolulu. The fish passing through these market channels are a subset of the entire Statewide commercial bottom fish catch. Significant markets also exist on Maui, Hawaii, and Kauai. Moreover, there is without doubt a substantial recreational-subsistence harvest of bottom fish. The catch totals compiled here, therefore, do not represent meaningful absolute statistics. The value of monitoring the catch at this wholesale

level is that it represents the most centralized point at which a large volume of landings can be intercepted and data economically collected. Because such a large share of the total Statewide catch of bottom fish is marketed there, trends and patterns in the data collected at the wholesale market are believed to be indicative of the fishery as a whole.

At the wholesale market bottom fish are auctioned either as individual fish or more commonly in lots. A lot is composed of a grouping of concantly, fish are sorted by size before assignment to lots, so that all specific fish from a single fisherman's landings on a given day. Signifithose within a single lot tend to be of similar size (Ralston, Tagami, and Shiota 1986). For each lot of fish sold at the market it is possible to record the following information: (1) the species, (2) the total weight (lb) of the lot, (3) the number of individual fish comprising it, (4) the fishing vessel landing the catch, (5) the general location of fishing, (6) the purchaser, (7) the bid price, and (8) the date of the transaction. Previous work has shown that one can recover 88.0-99.3% of the information regarding actual bottom fish size structure by examination of these simple lot statistics (Ralston, Tagami, and Shiota 1986). Thus, size-frequency analysis of these data is possible.

The above data were recorded for all lots of bottom fish sold over the 3 years spanning 1984-86. The data were entered into a computer file in which each lot of fish comprises one record (observation) composed of the eight variables listed above. Various summary statistics were computed using Statistical Analysis System computer routines (SAS 1985a, 1985b, 1985c).

Weight-frequency distributions were compiled and analyzed in detail to estimate various biological and fishery dependent parameters. For each distribution considered the ascending portion of the curve (including the modal size class) was used to determine the weight at entry to the fishery (w_c) as suggested by Gulland (1969). Species were assumed fully vulnerable to the gear in all weight categories greater than, but not equal to, the mode. The descending portion of each weight-frequency distribution (excluding the mode) was transformed to a length-frequency polygon using the length-weight regressions provided in Loubens (1980), Uchiyama et al. (1983), Brouard and Grandperrin (1984), and Ralston (in press). In all cases analyzed the descending portions of catch length-frequency distribuequivalent to assuming constant selectivity of the gear (hooks) over the tions were assumed to accurately depict stock size structure. This is full size range of the descending limb, i.e., a "trawl" type sigmoidal selection curve. It is noteworthy that evidence exists in support of this assumption (Ralston 1982; Ralston unpublished data), although it is undoubtedly a simplification of what is in reality a complex interaction between the fish and the fishing gear.

The descending limbs of length-frequency distributions, pooled over 1984-86, were used to estimate the maximum length parameter (L_∞) of the von Bertalanffy growth model using the regression method of Wetherall et al. (in press). The data were pooled due to the instability of L_∞ estimates calculated for each year separately. The growth coefficient (K) of the von

Bertalanffy model was estimated from L_∞ using the growth performance equation derived specifically for snappers and groupers by Manooch (1987). This in turn was used to estimate the natural mortality rate (M) as suggested by Ralston (1987) in his study of snapper and grouper mortality rates. Total mortality rates (Z) were estimated from the descending limbs of length-frequency distributions using both the Beverton and Holt (1956) length-based estimator and the length converted catch curve method of Pauly (1982). In general there were no systematic differences between the two estimates of Z (Fig. 1), so they were averaged to produce a final estimate of Z. Instantaneous fishing mortality rates (F) were determined by subtraction (F = Z-M) and ages at entry to the fishery (t_c) were calculated from w_c, the length-weight regression, and the estimates of von Bertalanffy growth parameters. Maximum weight parameters (W_∞) were estimated with the values of L_∞ and the appropriate length-weight regression.

Yield-per-recruit analyses were conducted using the various parameters estimated from size structure (W_∞, K, M, F, and t_c). All species were assumed to recruit to the fishery at age I (i.e., constant natural mortality rate thereafter) and the simplified cubic form of the equilibrium Beverton and Holt (1957) yield equation based on isometric growth was used in lieu of the more complicated computations involving the incomplete beta function (Wilimovsky and Wicklund 1963). Previous calculations by Ralston (1981) using the latter had failed to appreciably alter the analytical result for opakapaka, Pristipomoides filamentosus. As suggested by Ricker (1975) the upper bound of the yield equation integral was assumed infinite.

In addition to total landings and size structure, another useful application of the wholesale market data set is the calculation of fishing effort and catch per unit effort (CPUE) statistics for the Northwestern Hawaiian Islands (NWHI) fishery. All bottom fishing trips to the NWHI tend to be of relatively short duration (approximately 2 weeks) because the product is marketed fresh at the wholesale market. For the same reason, when brought to port a vessel's landings are quickly sold. On the other hand the distance to the fishing grounds requires a minimum of 4 days transit time. Thus, it is possible to determine the number of fishing trips to the NWHI each year by following the pattern of sales at the market by individual fishermen. While on occasion it may require as much as 4 days to completely offload and sell the catch obtained from any particular trip to the NWHI, if 5 consecutive business days elapse at the wholesale market in which no subsequent transactions relating to that vessel occur, the sales from that trip can be considered complete. The total trip landings can then be determined by summation and, by examining the sales by all fishermen at the wholesale market, the total number of bottom fishing trips to the NWHI can be calculated for any given time period.

RESULTS

The data were first summarized to determine what species of bottom fish appear in the wholesale market samples. The results given in Table 1 show that many species are sold at the market, although a small subset accounts for the preponderance of lots. In particular, seven species (opakapaka,

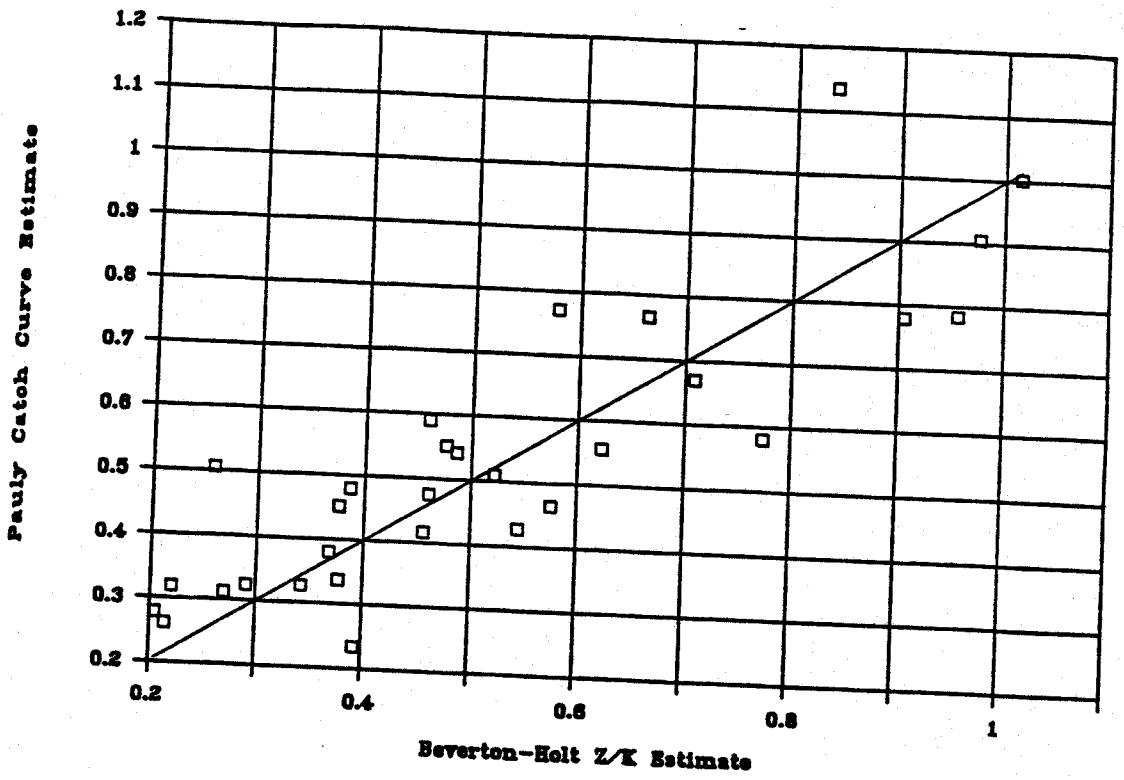


Figure 1.--A comparison of total mortality rate estimates (Z) derived from the Beverton and Holt (1956) length-based estimator and the Pauly (1982) length converted catch curve. The solid line represents equality of the estimates (units are per year).

Table 1.--Bottom fish species sold at the wholesale market from 1984 to 1986. The figures represent the percentage each species contributed to the total number of bottom fish lots in a year. A dash indicates trace quantities. Note that this table contains fish from areas other than Hawaii.

Family Species	Common name	1984	1985	1986
Lutjanidae				
Pristipomoides zonatus	Gindai	2.0	2.6	2.2
P. filamentosus	Opakapaka	28.8	20.0	18.8
P. sieboldii	Kalekale	3.8	5.3	3.9
P. flavipinnis	Yelloweye opakapaka	0.2	0.2	0.3
P. auricilla	Yellowtail kalekale	0.2	0.5	0.2
P. multidens	Goldbanded jobfish	0.1	0.4	0.4
P. argyrogrammicus	Ornate jobfish	—	—	—
P. typus	Sharptooth jobfish	—	—	—
Etelis coruscans	Onaga	14.7	21.4	21.2
E. carbunculus	Ehu	8.7	15.2	15.1
Lutianus kasmira	Taape	2.8	3.5	2.4
L. fulvus	Toau	0.9	0.6	0.8
Aphareus rutilans	Lehi	1.9	2.9	1.6
A. furca	Hanui	0.3	0.2	—
Aprion virescens	Uku	9.1	2.6	4.6
Paracaesio spp.	Various	—	0.2	0.4
—	"Snapper"	—	0.2	—
Emmelichthyidae				
Erythrocles schlegelii	Golden kalekale	0.2	0.2	0.2
Serranidae				
Epinephelus quernus	Hapuupuu	9.0	8.2	8.6
Epinephelus spp.	Various	0.3	0.4	0.5
Carangidae				
Pseudocaranx dentex	Butaguchi, pig ulua	4.9	5.4	5.9
Caranx ignobilis	White ulua	3.7	3.8	2.6
Caranx and *Carangoides* spp.	Ulua	7.2	4.5	8.1
Seriola spp.	Kahala	—	0.1	0.2
Scorpaenidae				
Pontinus macrocephalus	Hogo	1.1	1.5	1.6

onaga, ehu, uku, hapuupuu, butaguchi, and ulua) comprised 77.3-82.4% of all bottom fish lots sold from 1984 to 1986. The total numbers of bottom fish lots recorded during these years were 22,461, 34,612, and 39,840, respectively.

Fishing areas for the bottom fish sold at the wholesale market from 1984 to 1986 are presented in Table 2. In this table all areas are mutually exclusive categories, i.e., if a lot appears under the Twin Banks heading it does not appear under either the NWHI or Hawaiian Islands headings. Examination of the data in the table shows that out of State sales of fish are assuming increasing importance. Whereas in the past only American Samoa and Fiji shipped bottom fish to the wholesale market on a regular basis, in 1986 a wide variety of Pacific island nations marketed bottom fish in Honolulu. Nonetheless, bottom fish caught in Hawaii represent the vast majority of the market sampling data. In the first year of sampling 96.9% of all bottom fish lots were composed of fish caught in Hawaii. For the subsequent 2 years the figures are 93.9 and 89.6%.

A significant development in the collection of the location data is that the precision of the information has steadily improved. Since 1984, both the fraction and number of bottom fish lots classified to the "Hawaiian Islands" area category declined to zero. In 1986 it was possible to assign all Hawaiian bottom fish landings to either the main Hawaiian Islands (MHI) or the NWHI categories. Likewise, within the NWHI region, only 15% of the lots sampled in 1984 had the specific bank of harvest recorded. In 1986 the situation was reversed; 64% of all NWHI bottom fish lots were classified to specific bank or island locations. In spite of the marked improvement in the collection of the 1986 data, the fairly crude geographical resolution that characterizes the first 2 years of data precludes detailed treatment on a bank by bank basis. For this reason, the fundamental separation of MHI and NWHI landings was the only areal distinction made in the yield analyses that follow.

Moreover, due to the abundance of lot statistics for opakapaka, onaga, ehu, uku, hapuupuu, and butaguchi, and the relative paucity of data concerning the remaining species, detailed analyses were conducted only on this subset of species. Note that although "ulua" accounts for a substantial number of lots (4.5-8.1%), it is a heterogeneous group of species, each of uncertain taxonomic affiliation.

Landings of Hawaiian Bottom Fish at the Wholesale Market

The data presented in Table 3 summarize the total Hawaiian landings of opakapaka, onaga, ehu, uku, hapuupuu, butaguchi, and total bottom fish. The figures given represent only the catch that is known to have been caught in either the MHI or the NWHI. However, the remaining "Hawaiian Islands" catch (see Table 2) amounts to no more than 3.4% of these totals. In aggregate this catch represents 82.4-86.9% of all the bottom fish sold at the wholesale market from 1984 to 1986, regardless of species or area caught.

Table 2.--Harvest locations of bottom fish appearing at the wholesale market during 1984-86. The figures represent the percentage each area contributed to the total number of bottom fish lots in a year. A dash indicates trace quantities and a zero no recorded landings. All area categories are treated as mutually exclusive.

Area	1984	1985	1986
Hawaiian Islands	2.4	1.3	0
Main Hawaiian Islands	3.7	2.2	0.4
Hawaii	10.0	18.0	12.3
Maui	0.5	—	0.2
Molokai	1.6	2.7	3.1
Oahu	37.0	31.1	37.0
Kauai	7.1	6.1	2.3
Northwestern Hawaiian Islands	29.5	29.7	12.3
Middle Bank	0.1	0	0.6
Nihoa	—	0.1	0.8
Twin Banks	0	0.9	0.3
Necker Island	0.6	0.3	1.3
French Frigate Shoals	1.0	0.3	0.9
Brooks Banks	2.6	0	0.5
Gardner Pinnacles	0.4	0	2.4
Raita Bank	0	0	1.5
Maro Reef	0	0	0.7
Laysan Island	0.4	0.1	1.4
Northampton Seamounts	0	0	0.8
Pioneer Bank	0	0.2	1.0
Lisianski Island	0	0	9.0
Pearl and Hermes Reef	0	0	0.6
Line Islands	0	0	0.1
Tahiti	0	—	0
American Samoa	2.1	0.6	1.2
Western Samoa	0	0	—
Tonga	0	—	0.1
Fiji	0.9	3.3	6.8
Vanuatu	0	—	0.1
Federated States of Micronesia	0	0	0.1
Pohnpei	0	0	—
Yap	0	0	—
New Zealand	0	0	0.2
Australia	0	0	1.5
Palau	0	2.1	0.1
Guam	0	0.1	0.1
Taiwan	0	0	0.1

Table 3.—Total landings (in metric tons) of Hawaiian bottom fish from the main Hawaiian Islands and the Northwestern Hawaiian Islands.

	1984	1985	1986
Opakapaka			
Main Hawaiian Islands	37.5	30.9	34.2
Northwestern Hawaiian Islands	143.4	140.5	119.8
Onaga			
Main Hawaiian Islands	36.7	64.4	56.2
Northwestern Hawaiian Islands	3.1	23.4	43.1
Ehu			
Main Hawaiian Islands	6.5	12.9	11.6
Northwestern Hawaiian Islands	2.2	9.3	11.8
Uku			
Main Hawaiian Islands	31.1	8.1	20.1
Northwestern Hawaiian Islands	3.4	0.7	3.0
Hapuupuu			
Main Hawaiian Islands	6.7	3.4	3.4
Northwestern Hawaiian Islands	46.1	66.5	84.3
Butaguchi			
Main Hawaiian Islands	0.8	0.4	0.6
Northwestern Hawaiian Islands	29.5	56.2	63.5
All six species			
Main Hawaiian Islands	119.4	120.1	126.0
Northwestern Hawaiian Islands	227.7	296.5	325.5

It is apparent from these results that opakapaka has been the mainstay of the bottom fish fishery in Hawaii, especially if only the NWHI is considered. For example, this species alone comprised over half the Hawaiian bottom fish share of the wholesale market in 1984. However, there has been a marked (16.5%) decline in the harvest of this species in the NWHI over the period in question. In contrast, landings from the MHI appear to be relatively stable.

Onaga is the second most important species in the Hawaiian deep-sea handline fishery, contributing 22.0% to the 1986 total. In contrast to opakapaka, the catch of this species has generally risen from 1984 to 1986, most notably in the NWHI where landings increased fourteenfold in 3 years. Moreover, in the last 3 years the onaga catch from the MHI has generally exceeded opakapaka landings from the same area.

From 1984 to 1986 the catch of ehu from the NWHI increased markedly, likely in direct association with the increase in onaga landings. Both species inhabit deeper habitats than opakapaka and, for that reason, they tend to co-occur in the catch (Ralston and Polovina 1982).

As measured by the coefficient of variation (CV), landings of uku from the MHI are highly variable (CV = 58%). The fishery for this species is very seasonal during the early summer months (Ralston 1979), a time when uku aggregate to spawn. Because no other Hawaiian bottom fish is known to similarly aggregate, this aspect of the life history may be related in some way to the relatively high variation in catch between years. Moreover, it is evident from the data in Table 3 that compared with the MHI, the NWHI harvest of uku is presently negligible. Insufficient numbers of uku were recorded from the NWHI region to perform a size structured analysis of yield per recruit, although a number of fishermen have displayed an increasing interest in the Middle Bank and Necker Island stocks of uku.

Like the onaga and ehu, landings of hapuupuu from the NWHI have increased dramatically in recent years (83%). While substantially less than the NWHI, the MHI catch is nonetheless of sufficient magnitude to allow a yield analysis. The data suggest that the MHI hapuupuu catch may be waning. Overall the hapuupuu is the third most important species of bottom fish in the Hawaiian fishery on the basis of landed weight, trailing opakapaka and onaga.

The geographical distribution of butaguchi is limited almost entirely to the NWHI, where almost 99% of all landings are taken. This pattern is reciprocal to that of the uku. Consequently, insufficient quantities of butaguchi were landed from the MHI to analyze further. In parallel with onaga, hapuupuu, and ehu, landings of butaguchi from the NWHI show a steady increase from 1984 to 1986, rising 115% during this time.

The general pattern of the wholesale market landings of these six species taken together shows a distinct difference between the trends in the MHI and NWHI regions. In aggregate, over the 3-year span for which there are data, the MHI catch has been very stable (CV = 3.0%) while the NWHI catch has increased 43.0%.

It is also of considerable interest to compare the wholesale market landings of bottom fish from the MHI and the NWHI with our current estimates of the maximum sustainable yield (MSY) from these areas. In a memorandum to the members of the Bottom Fish Planning Team dated 27 March 1986, Stephen Ralston of the National Marine Fisheries Service, Southwest Fisheries Center Honolulu Laboratory summarized information pertaining to estimates of bottom fish productivity (Ralston and Polovina 1982; Polovina 1984; Polovina and Ralston 1986) and habitat area within the Hawaiian Islands. Bottom fish MSY for the MHI was estimated to be 285 t, while for the primary fresh access zone of the NWHI (Nihoa to Lisianski Island) it was set at 275 t. The data presented in Table 3 show that over the last 3 years the MHI "wholesale market" harvest level has been stable at a value somewhat less than our best estimate of MSY. In fact, these data indicate that only 43% of the potential MHI yield is being caught and marketed at

the wholesale level. By comparison the 1986 NWHI catch of bottom fish sold at the wholesale market is substantially in excess of the projected MSY (18% greater).

Size Structured Analysis

In this section the size structure of six different species (opaka-paka, onaga, ehu, uku, hapuupuu, and butaguchi) will be considered in some detail. Moreover, the wholesale market landings of these fishes have been separated into MHI and NWHI categories. As previously indicated, the NWHI catch of uku and the MHI catch of butaguchi were insufficient to perform yield-per-recruit analyses. This leaves 10 different species by area combinations to examine.

Main Hawaiian Islands Opakapaka

Weight-frequency histograms for the 1984-86 catch of MHI opakapaka are presented in panels A-C of Figure 2. Note that the presence of individuals in the "0" pound weight class (e.g., for 1984 and 1986) indicates the existence of some illegal fish weighing 0.00-0.50 lb. This is because all weights were rounded to the nearest integer. Note also that the modal size of MHI opakapaka dropped from 1.36 kg (3 lb) in 1984 to 0.91 kg (2 lb) in 1985 and 1986.

Panel D of Figure 2 provides the relative length structure of MHI opakapaka during the time period in question. These data, jointly and in isolation, were used to estimate the following parameters: L_∞, W_∞, Z, w_c, and t_c (Table 4). It was then possible to perform a yield-per-recruit analysis (Fig. 3), the results of which indicate that over the 1984-86 period the age at entry to the fishery (t_c) has dropped substantially as fishing mortality rate has increased. If the current trend continues yield per recruit will decline. Ralston and Kawamoto (1985) believed the 1984 value of t_c to be slightly less than 2.0 years, while that given here is approximately 3.0. The difference in estimates is due to the more limited data available to the former study (1,347 MHI opakapaka sampled in the 6 weeks from mid-January to the end of February). In any event, the primary conclusion at this point is that the age at entry is presently too low.

Northwestern Hawaiian Islands Opakapaka

Similar data are presented in Table 4 and Figures 4 and 5 for the NWHI "stock" of opakapaka. The histograms show that NWHI opakapaka are generally much larger than their MHI counterparts. Relatively speaking, very few small fish are landed from the NWHI, i.e., t_c is quite high. Neither is there evidence of growth overfishing due to excessive fishing effort. Moreover, the current trend appears to indicate a lessening of fishing mortality and an increase in the age at entry. This result is likely due to relatively unexploited fishing grounds being targeted in 1985 and 1986, with the catch demonstrating a virgin size structure (see section on

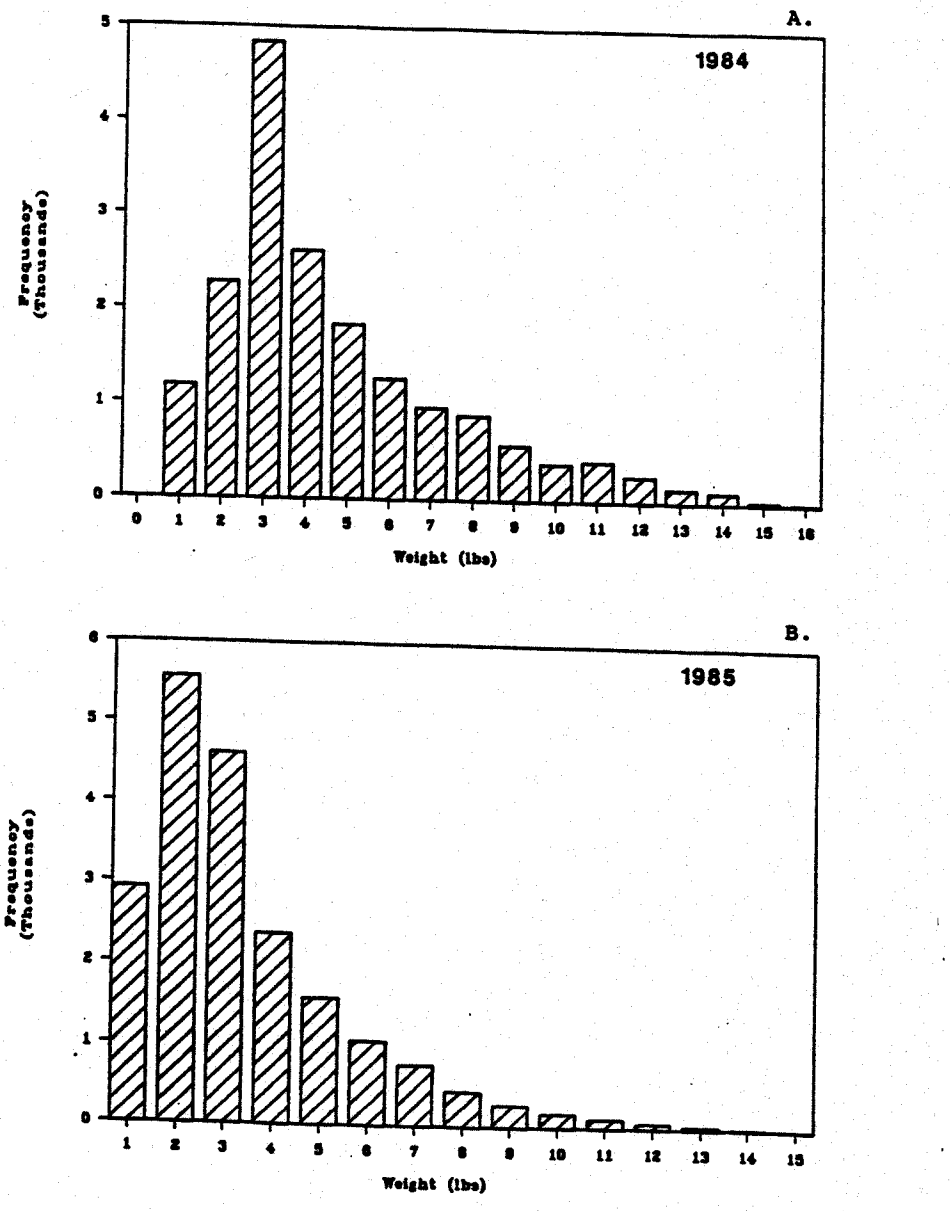
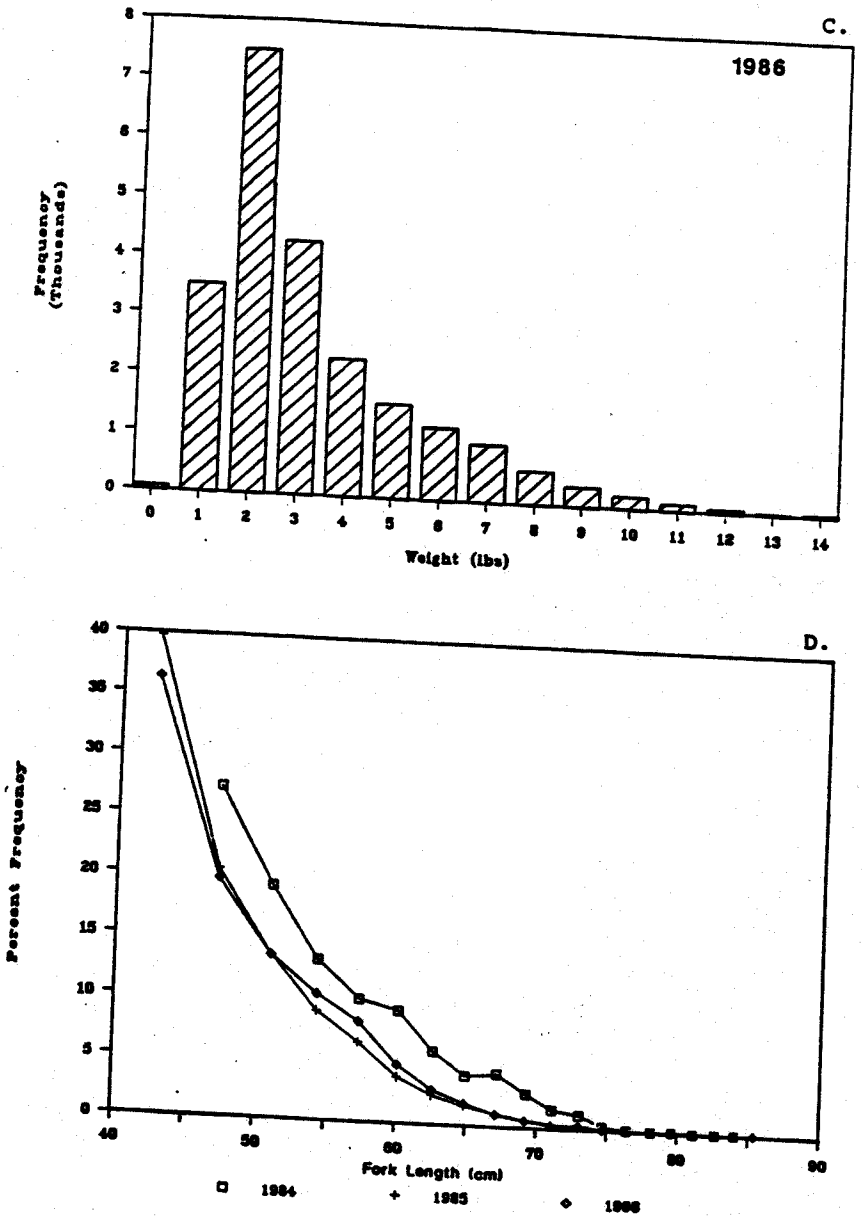


Figure 2.--Size structure of opakapaka landed from the main Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.



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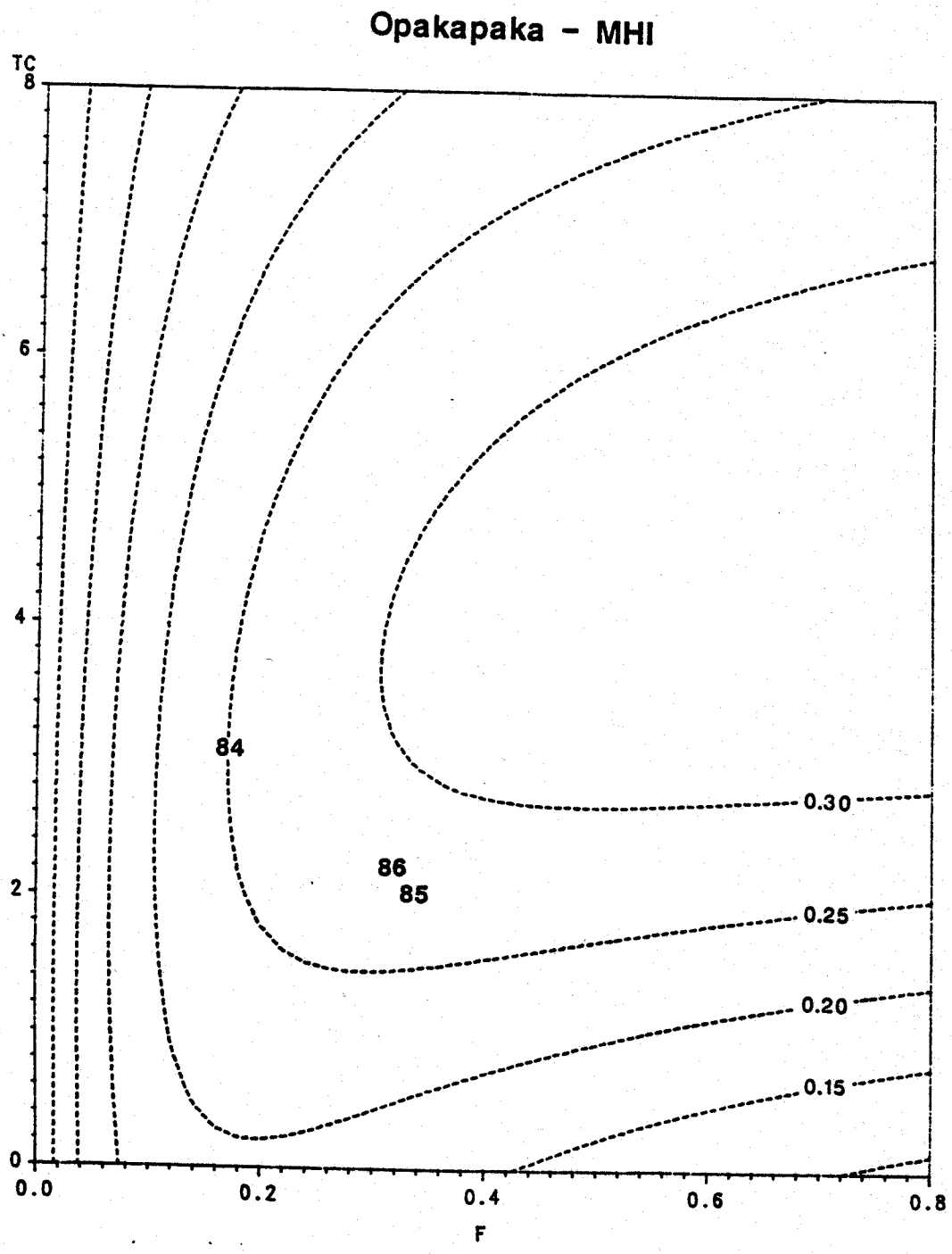


Figure 3.--Yield-per-recruit analysis for opakapaka caught in the main Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

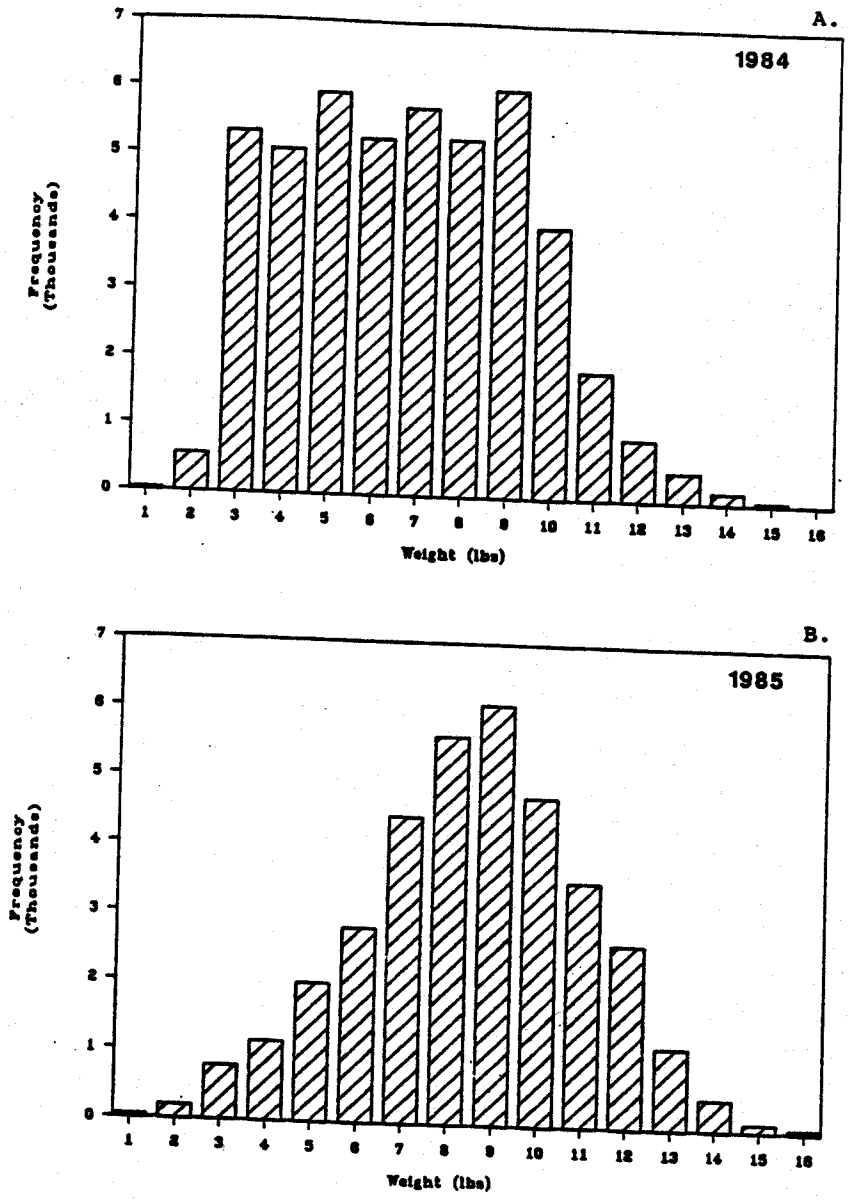


Figure 4.—Size structure of opakapaka landed from the Northwestern Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.

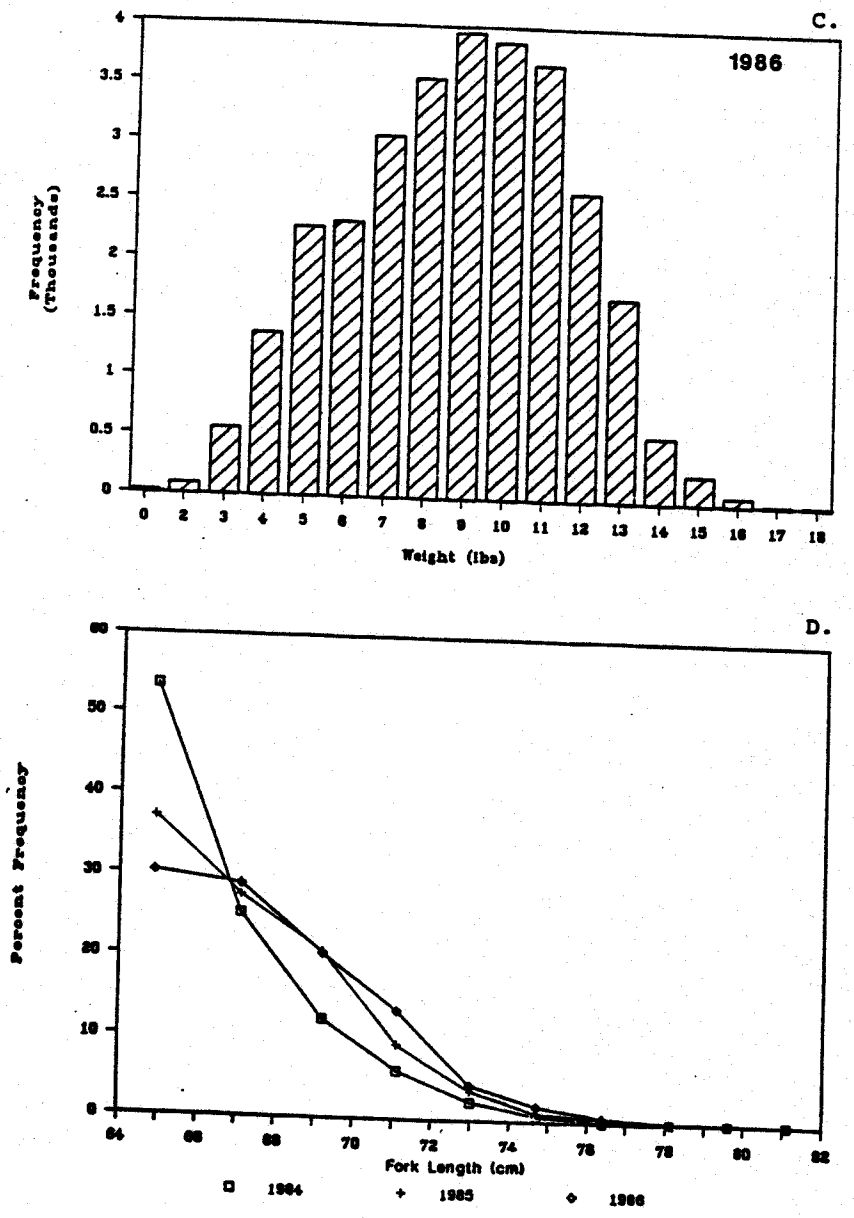


Figure 4.--Continued.

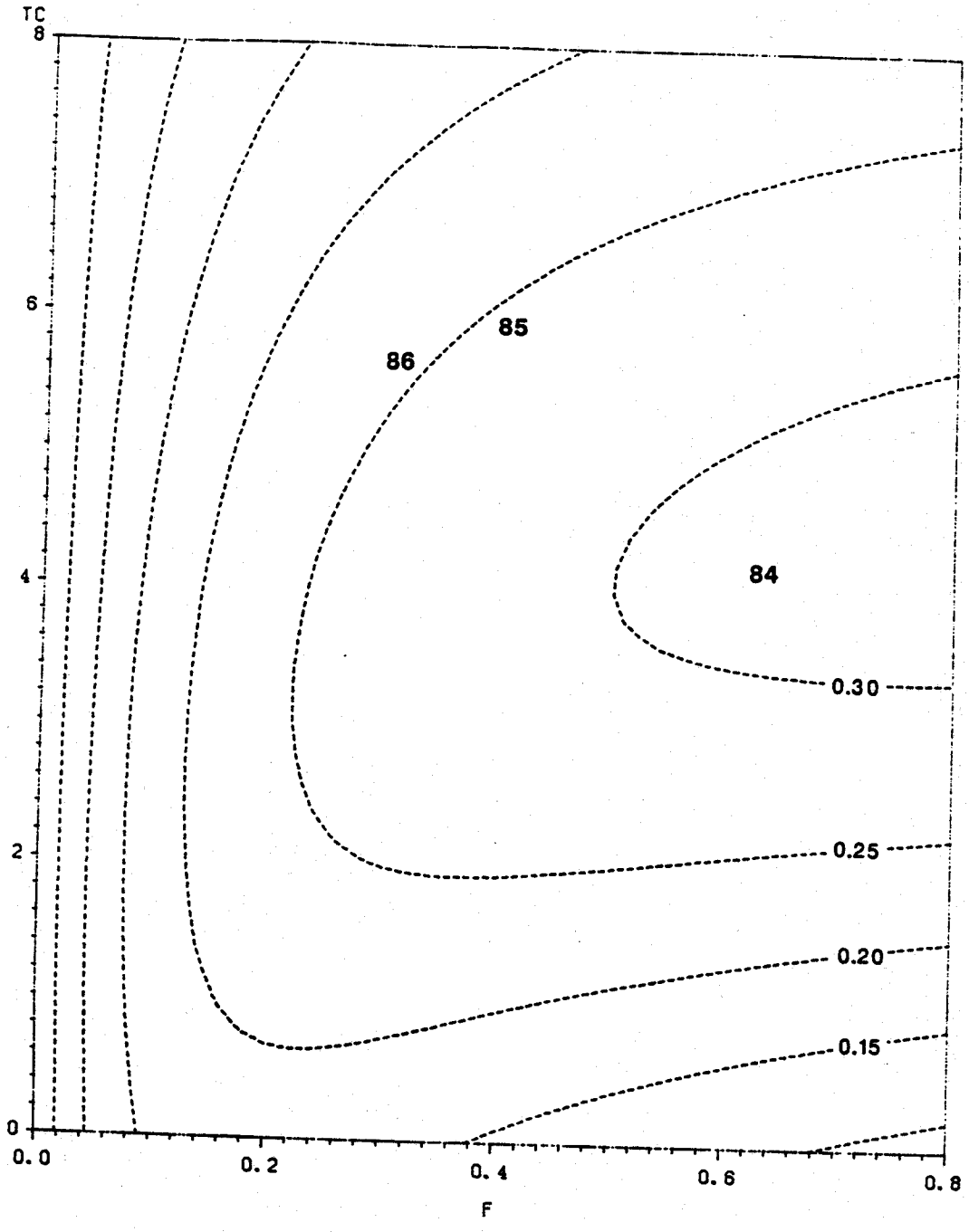


Figure 5.--Yield-per-recruit analysis for opakapaka caught in the Northwestern Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

Table 4.--Parameter estimates for bottom fish yield assessments: L_∞ = von Bertalanffy asymptotic length (cm), SE(L_∞) = standard error of L_∞, K = von Bertalanffy growth coefficient (per year), M = natural mortality rate (per year), W_∞ = von Bertalanffy asymptotic weight (kg), w_c = weight at entry to the fishery (kg), t_c = age at entry to the fishery (year), F = fishing mortality rate (per year).

	Opakapaka		Onaga		Ehu		Uku	Hapuupuu		Butaguchi
	MHI	NWHI	MHI	NWHI	MHI	NWHI	MHI	MHI	NWHI	NWHI
L_∞	86.6	83.7	89.4	95.7	82.1	69.4	116.5	118.6	108.0	98.6
SE(L_∞)	1.62	3.12	0.63	1.59	2.21	1.06	3.64	0.70	1.02	1.62
K	0.146	0.150	0.143	0.137	0.151	0.169	0.120	0.119	0.126	—
M	0.293	0.299	0.287	0.274	0.303	0.338	0.241	0.238	0.253	—
W_∞	10.4	9.43	10.8	13.2	10.3	6.13	24.35	32.13	24.03	17.2
1984										
w_c	0.8	1.4	0.6	4.3	0.2	0.6	2.3	1.4	1.0	2.8
t_c	2.97	4.18	2.56	7.64	1.49	3.09	4.61	3.15	2.87	—
F	0.16	0.61	0.05	0.14	0.55	0.15	0.51	0.12	0.00	—
1985										
w_c	0.4	2.6	0.6	3.7	0.2	0.6	2.0	1.3	1.1	3.6
t_c	2.02	6.14	2.56	6.89	1.49	3.09	4.29	3.04	3.01	—
F	0.33	0.37	0.01	0.26	0.75	0.06	0.44	0.11	0.00	—
1986										
w_c	0.5	2.3	0.5	3.8	0.2	0.7	2.4	1.3	1.1	2.1
t_c	2.28	5.67	2.32	7.02	1.49	3.36	4.70	3.04	3.01	—
F	0.28	0.28	0.00	0.20	0.70	0.13	0.70	0.12	0.00	—

geographical patterns of fishing in the NWHI). Additionally there is a trend within the NWHI fishery to use larger size hooks, perhaps favoring the catch of larger fish (but see Ralston 1982).

Main Hawaiian Islands Onaga

The data presented in Table 4 and Figures 6 and 7 form the basis for a assessing the MHI fishery for onaga. The histograms indicate that, like the opakapaka, onaga are entering the fishery at a very small size (a 2-lb mode in 1985 and 1986). However, the length-frequency polygon overlay for the data from all 3 years (panel D, Fig. 6) provides no indication of a high mortality rate. The descending limbs of all three curves do not show excessive curvature. These results are indicative of a stock under light exploitation, as evidenced by the low estimates of fishing mortality in Figure 7. Even with the low age at entry to the fishery there is at present no indication that the resource is overfished. To the contrary, all the evidence suggests that MHI onaga are presently underutilized.

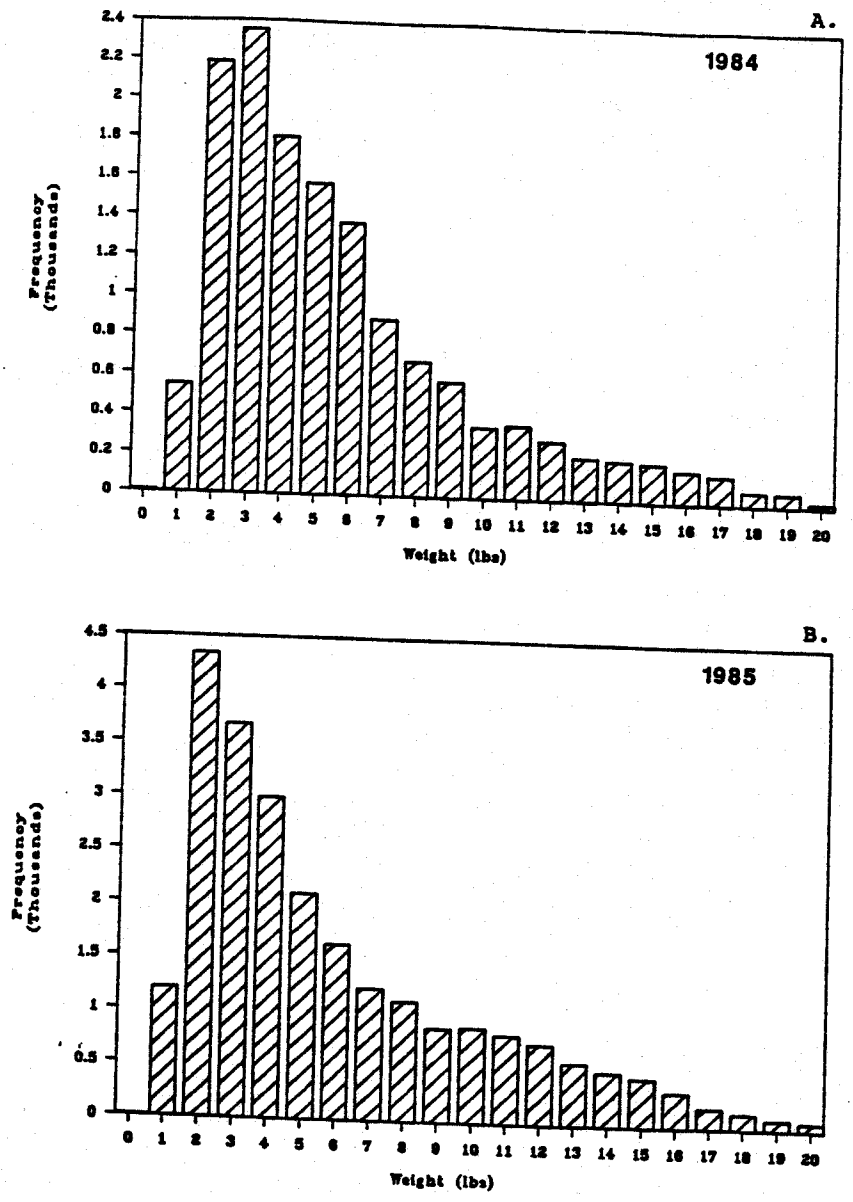
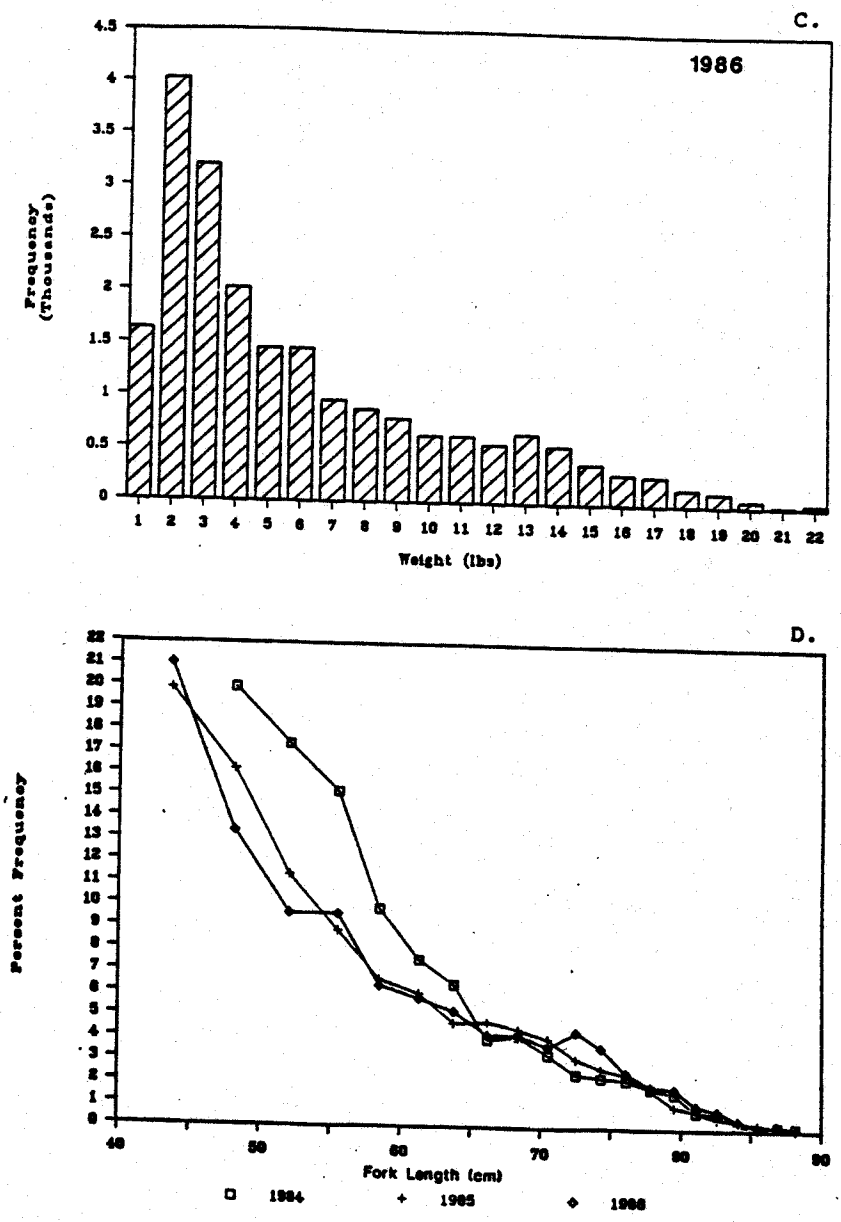


Figure 6.—Size structure of onaga landed from the main Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.



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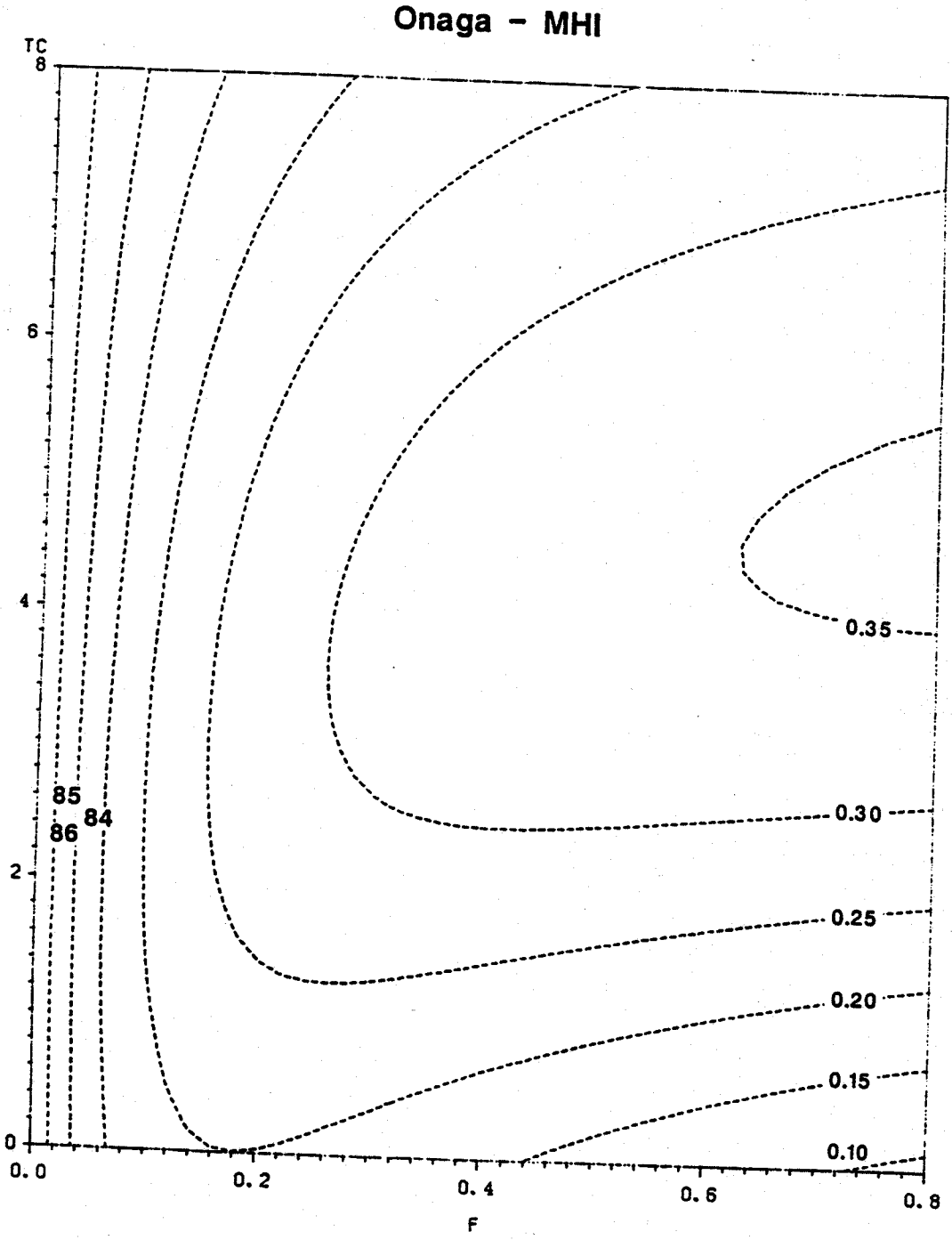


Figure 7.--Yield-per-recruit analysis for onaga caught in the main Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

Northwestern Hawaiian Islands Onaga

The analysis for NWHI onaga indicates a very high age at entry to the fishery (greater than 6 years) and a moderate level of fishing mortality (Table 4; Figs. 8 and 9). Because the modes of the histograms for 1984-86 are all in excess of 11 lb, the descending limbs presented in the relative length-frequency polygon overlay (panel D, Fig. 8) span a very small range in length, approximately 15 cm. This narrow range exacerbates the problem of estimating mortality rates due to the increased likelihood of substantial measurement and sampling errors. The fishery for onaga in the NWHI is relatively new, as evidenced by the fact that only 3.1 t were landed in 1984 (see discussion above). A change in size structure that would lead to a significant estimate of fishing mortality is not to be expected over so short a time interval. As pointed out by Ricker (1975), "survival rates which we estimate from age frequencies in a catch are ancient history." The same holds true for length frequencies. The estimates of fishing mortality for onaga caught in the NWHI (Table 4 and Fig. 9) are therefore in need of further validation and study.

Main Hawaiian Islands Ehu

Presented in Table 4 and Figures 10 and 11 are the results concerning the MHI fishery for ehu. It is clear that this species does not reach the large size characteristic of opakapaka and onaga. It is also apparent that, like the MHI fisheries for these other species, the age at entry for the ehu fishery is very low. The mode of all three histograms for the years 1984-86 is 1 lb. But unlike MHI onaga, substantial curvature exists in the descending limbs of the length-frequency polygons (panel D, Fig. 10). This characteristic is indicative of a high fishing mortality, at least for snappers and groupers (Ralston 1987). The yield-per-recruit analysis suggests that the fishery is overexploited (Fig. 11). Based on the data available, an increase in the age at entry to the fishery (t_c) would have a substantially beneficial effect on yield.

Northwestern Hawaiian Islands Ehu

A similar analysis was performed on the NWHI stock of ehu, the results of which are presented in Table 4 and Figures 12 and 13. When compared with the MHI, the ehu that are harvested in the NWHI are of a much larger size. Fish are entering the fishery at a weight three times that of the MHI (compare values of w_c in Table 4). Likewise, the age at entry is over twice as great. Neither is there excessive curvature in the descending limbs of the length-frequency distributions for 1984-86. The overall result (Fig. 13) is that the NWHI fishery for ehu is not fully utilized. Improvements to yield could be realized by increasing the existing level of fishing mortality.

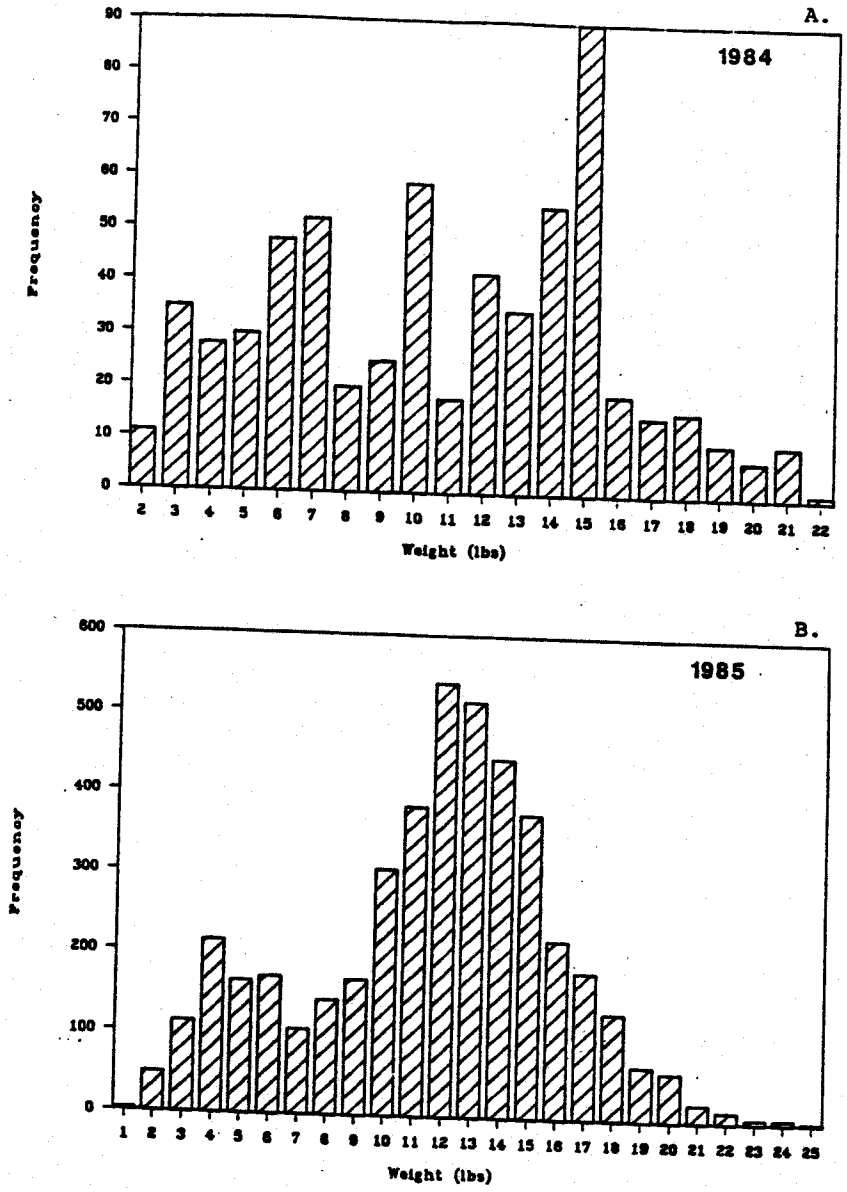
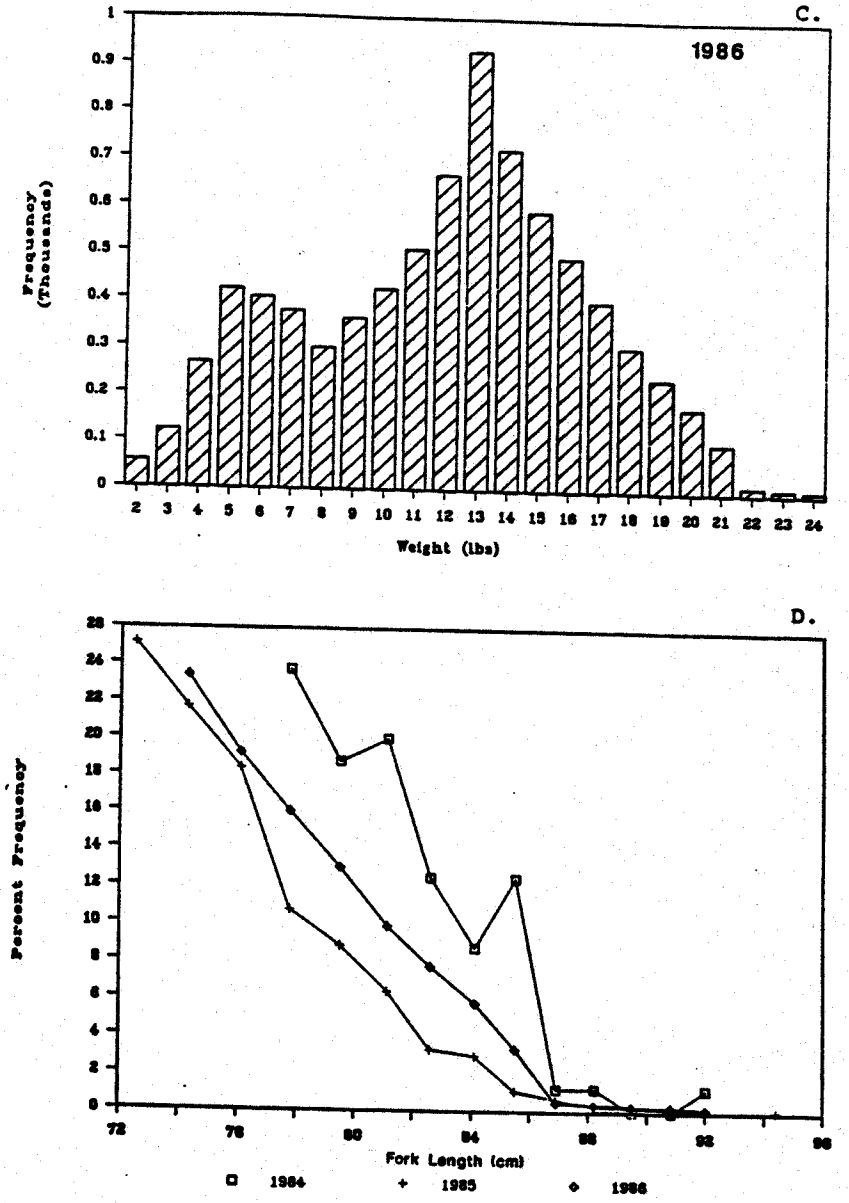


Figure 8.--Size structure of onaga landed from the Northwestern Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.



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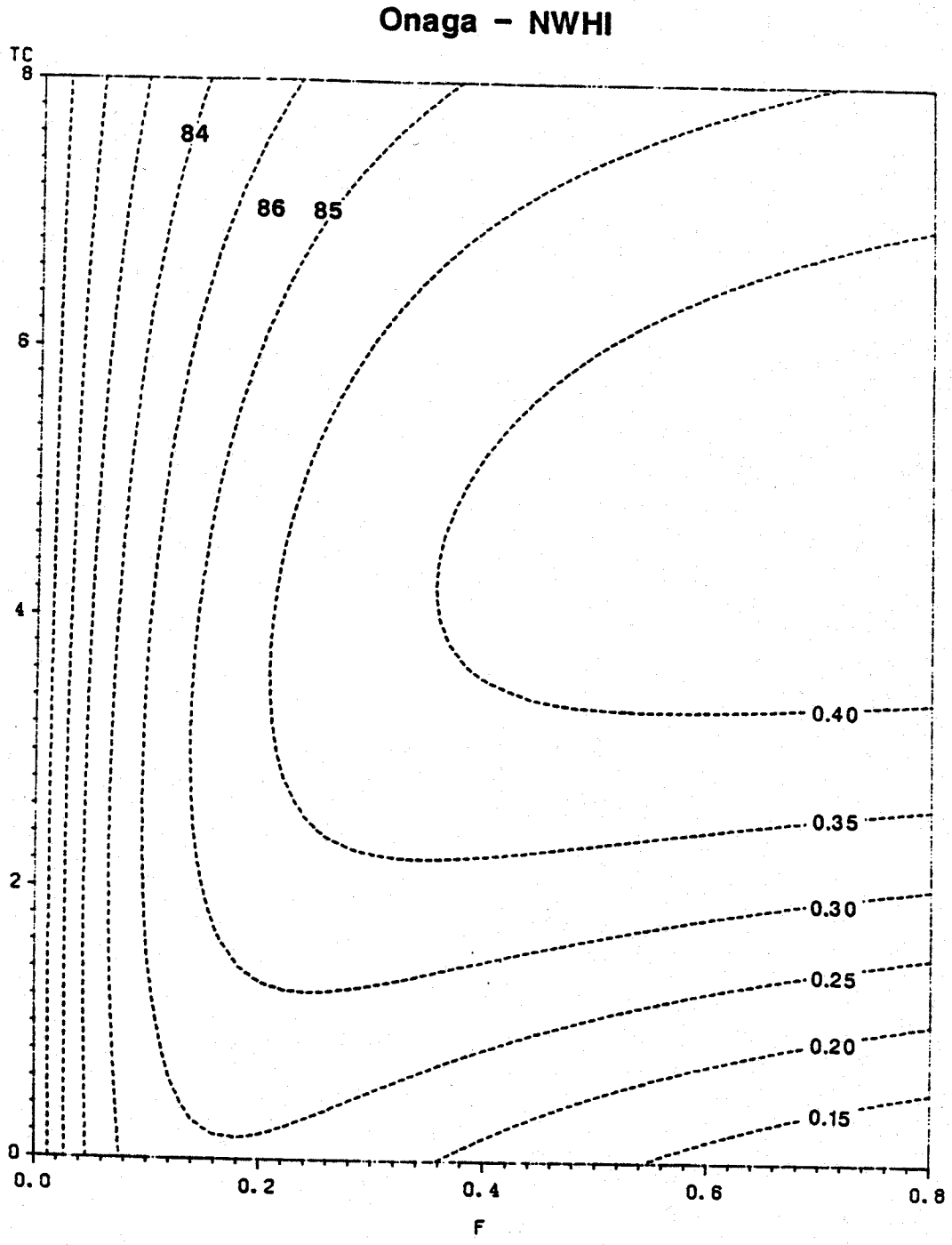


Figure 9.--Yield-per-recruit analysis for onaga caught in the Northwestern Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

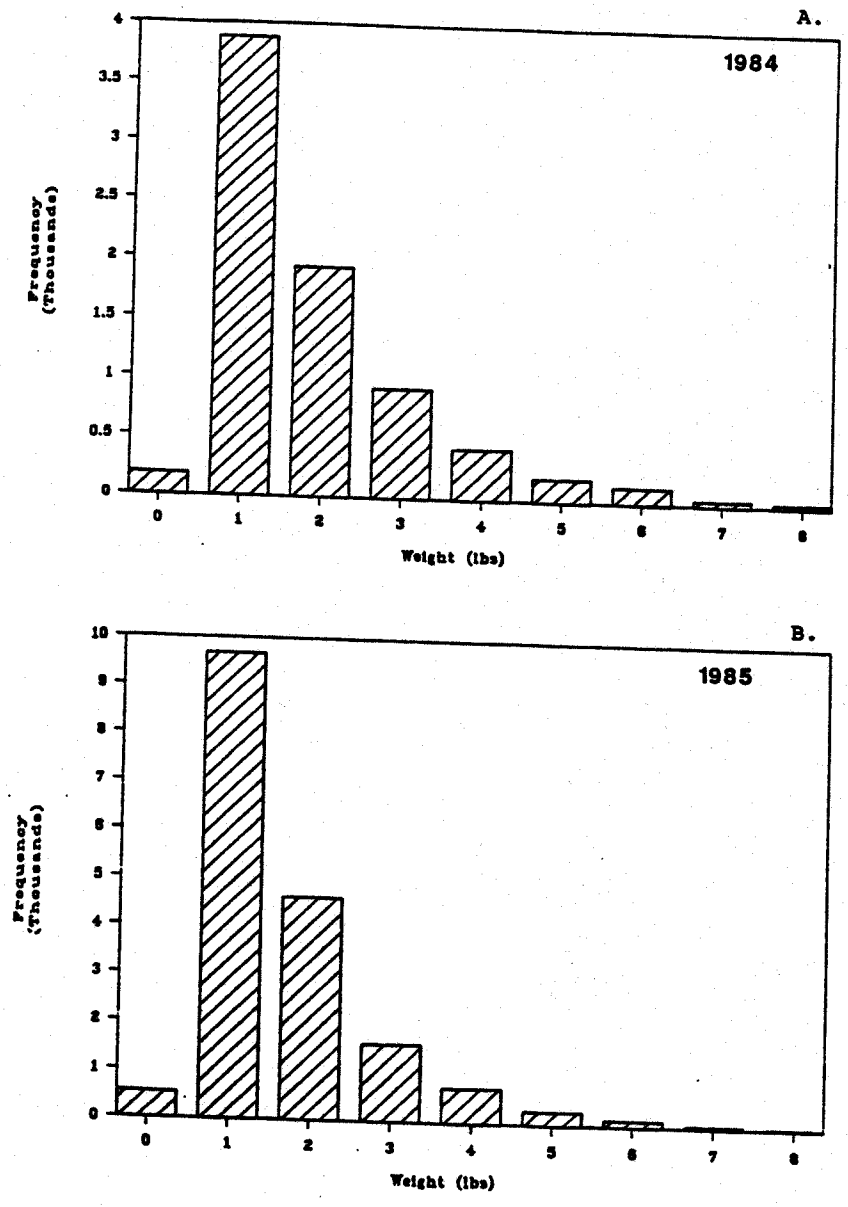
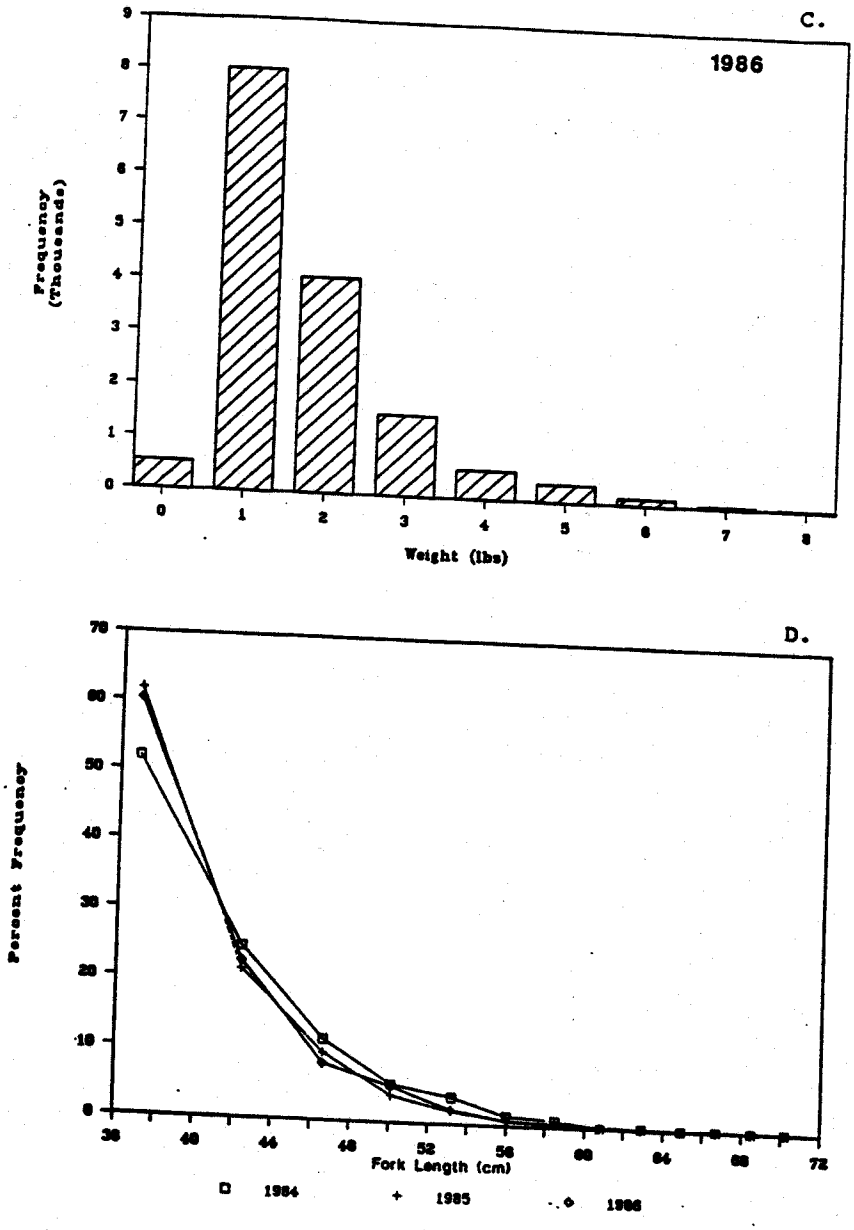


Figure 10.--Size structure of ehu landed from the main Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.



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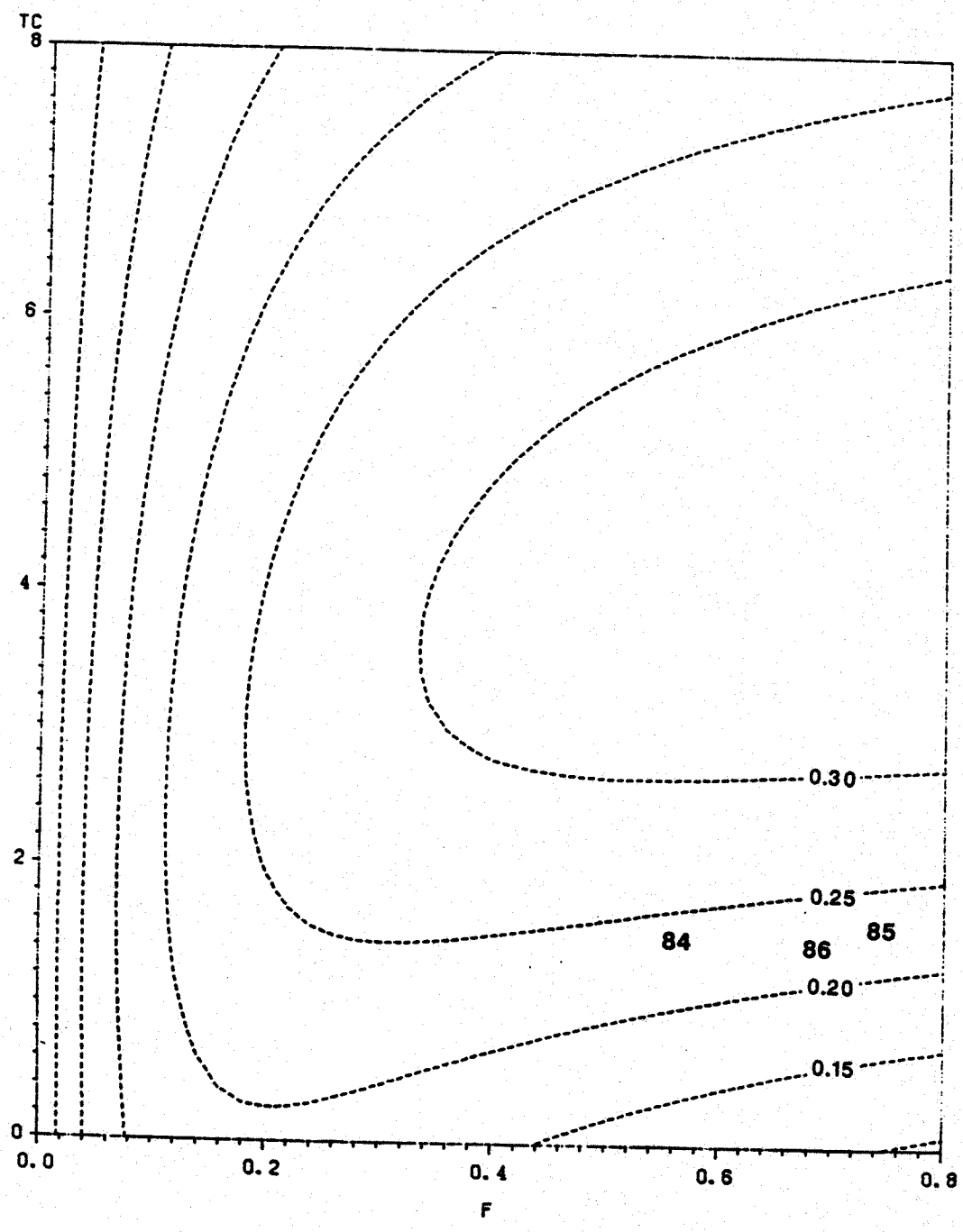


Figure 11.--Yield-per-recruit analysis for ehu caught in the main Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

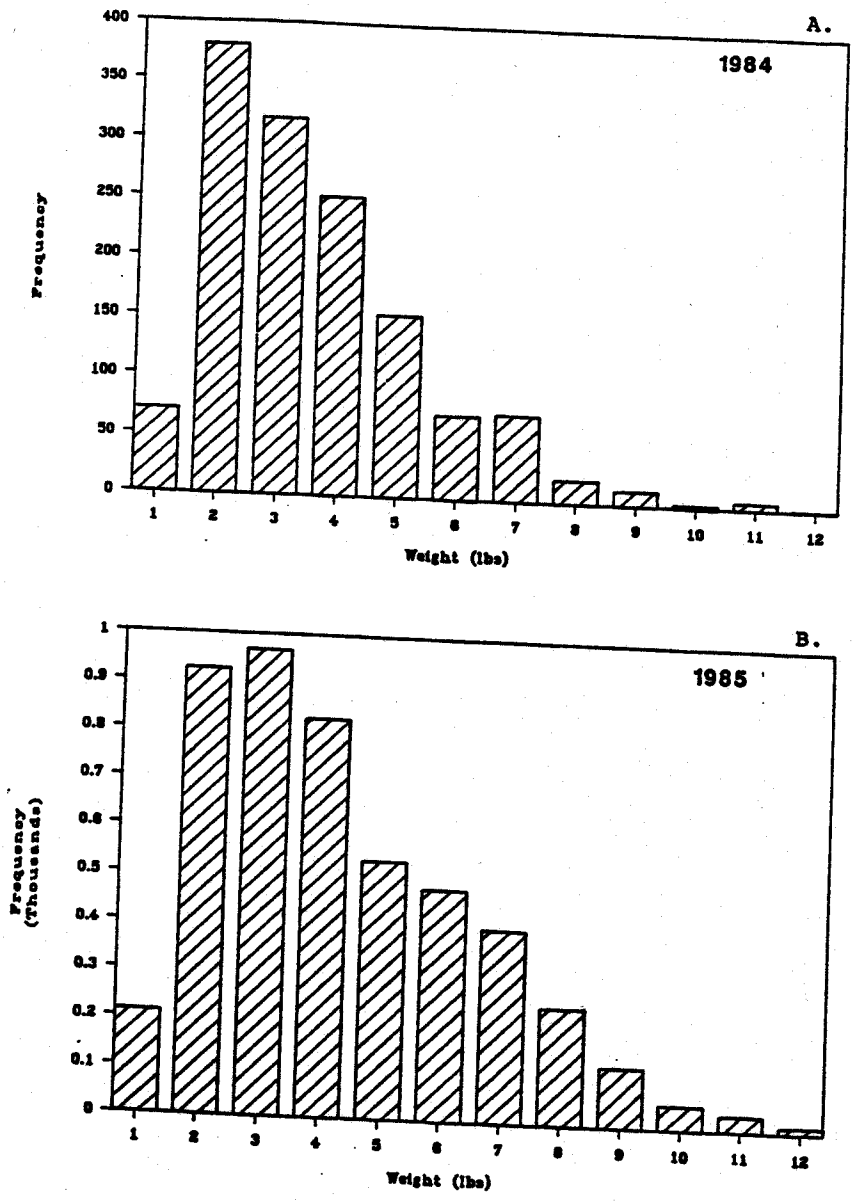


Figure 12.--Size structure of ehu landed from the Northwestern Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.

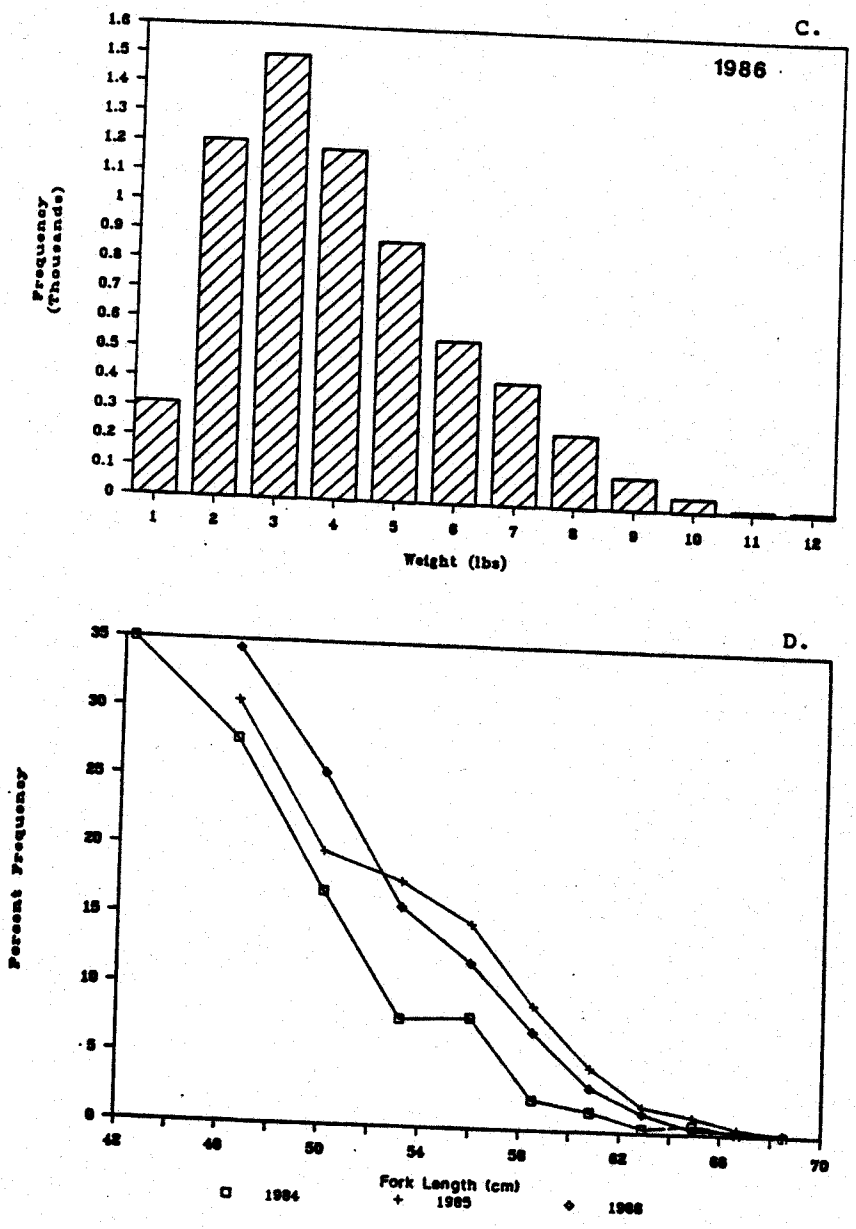


Figure 12.--Continued.

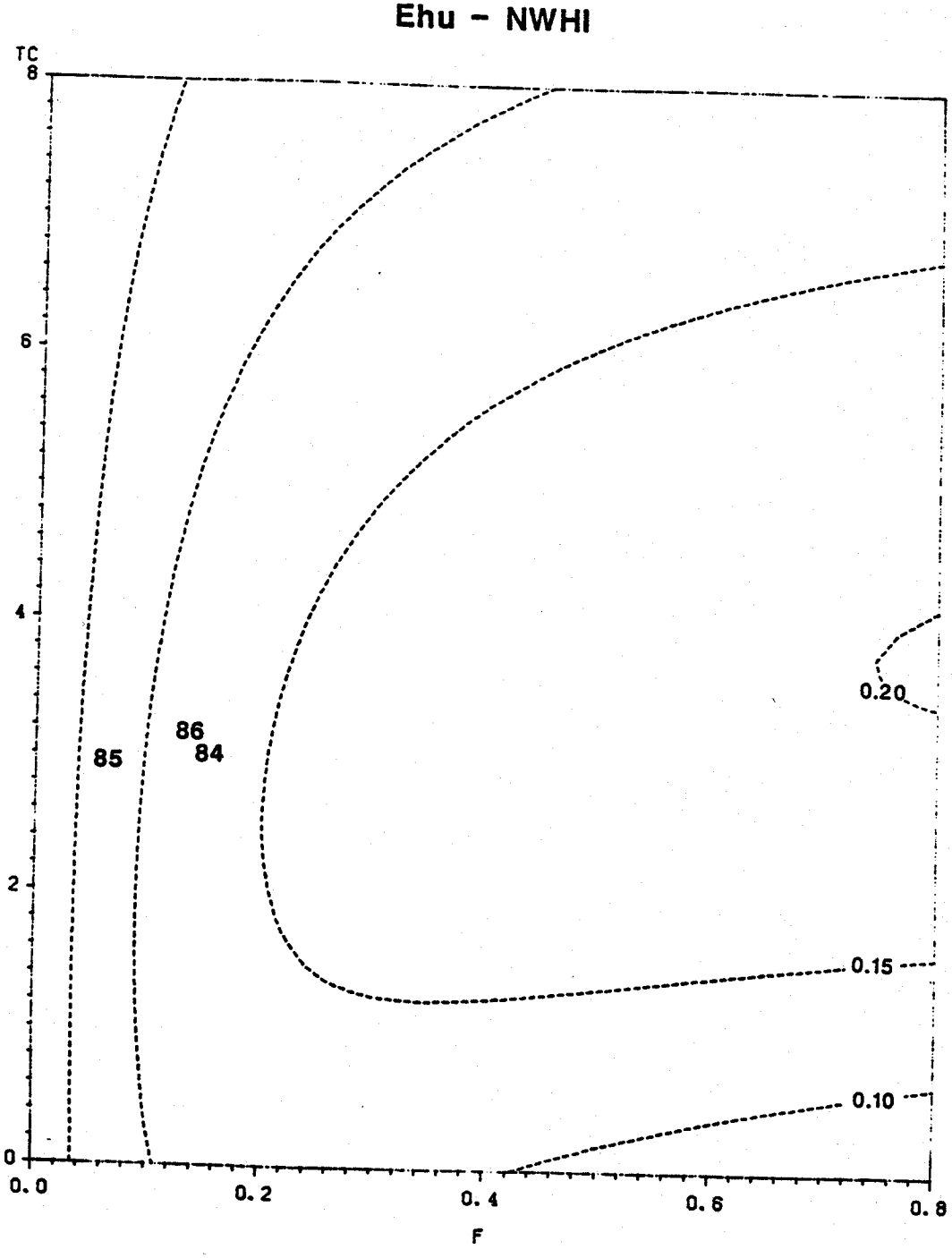


Figure 13.--Yield-per-recruit analysis for ehu caught in the Northwestern Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

Main Hawaiian Islands Uku

The MHI fishery for uku stands in contrast to the other MHI fisheries discussed so far. The weight and age at entry to the fishery (Table 4) are much greater than for opakapaka, onaga, and ehu. The poor representation of small uku in the MHI catch (Fig. 14) is believed to be due to their unavailability. As indicated previously, the uku fishery generally targets fish that are aggregated for spawning, effectively conserving the pre-reproductive portion of the resource. Nonetheless, the MHI stock of uku is intensively exploited. The descending limbs of the relative length-frequency distributions for 1984-86 all demonstrate substantial curvature. Even with a much greater age at entry than the MHI fisheries already examined, the uku fishery would appear to be slightly overexploited (Fig. 15). Certainly no reduction in t_c is desirable at this time, and fishing mortality is already much greater than natural mortality (Table 4), a warning sign for snapper and grouper fisheries (Polovina 1987; Ralston 1987).

Main Hawaiian Islands Hapuupuu

The data presented in Table 4 and Figures 16 and 17 summarize the biological assessment and yield analysis for MHI hapuupuu. The weight at entry to the fishery is not great (about 1.3 kg), but neither is the estimated fishing mortality rate. In fact, the estimated position of the fishery on the isopleth surface from 1984 to 1986 places it close to the eumetric fishing line. Thus, given the prevailing level of fishing mortality, the current age at entry to the fishery (t_c) is near optimal. If fishing mortality were to increase very much, however, an increase in t_c would be desirable.

Northwestern Hawaiian Islands Hapuupuu

Hapuupuu harvested in the NWHI actually become vulnerable to fishing at a smaller size and age than do MHI conspecifics (Table 4). This is the only species to demonstrate this reversal of form. Nonetheless, as evidenced by the near linear descending limbs of the three length-frequency polygons in panel D of Figure 18, the ratio of total mortality rate to von Bertalanffy growth coefficient (Z/K) is approximately 2.0. A ratio of 2.0 is typically indicative of an unexploited grouper stock (Ralston 1979). Hence the yield-per-recruit analysis (Fig. 19) shows the NWHI stock of hapuupuu to be underutilized. If true, a moderate increase in fishing effort should produce a major increase in yield per hapuupuu recruit.

Northwestern Hawaiian Islands Butaguchi

The butaguchi is a carangid and cannot be analyzed using the methods employed up to this point. For all the species treated so far, the von Bertalanffy growth coefficient (K) and natural mortality rate (M) were estimated using the regression equations provided in Manooch (1987) and Ralston (1987). These two equations relate specifically to snappers and groupers

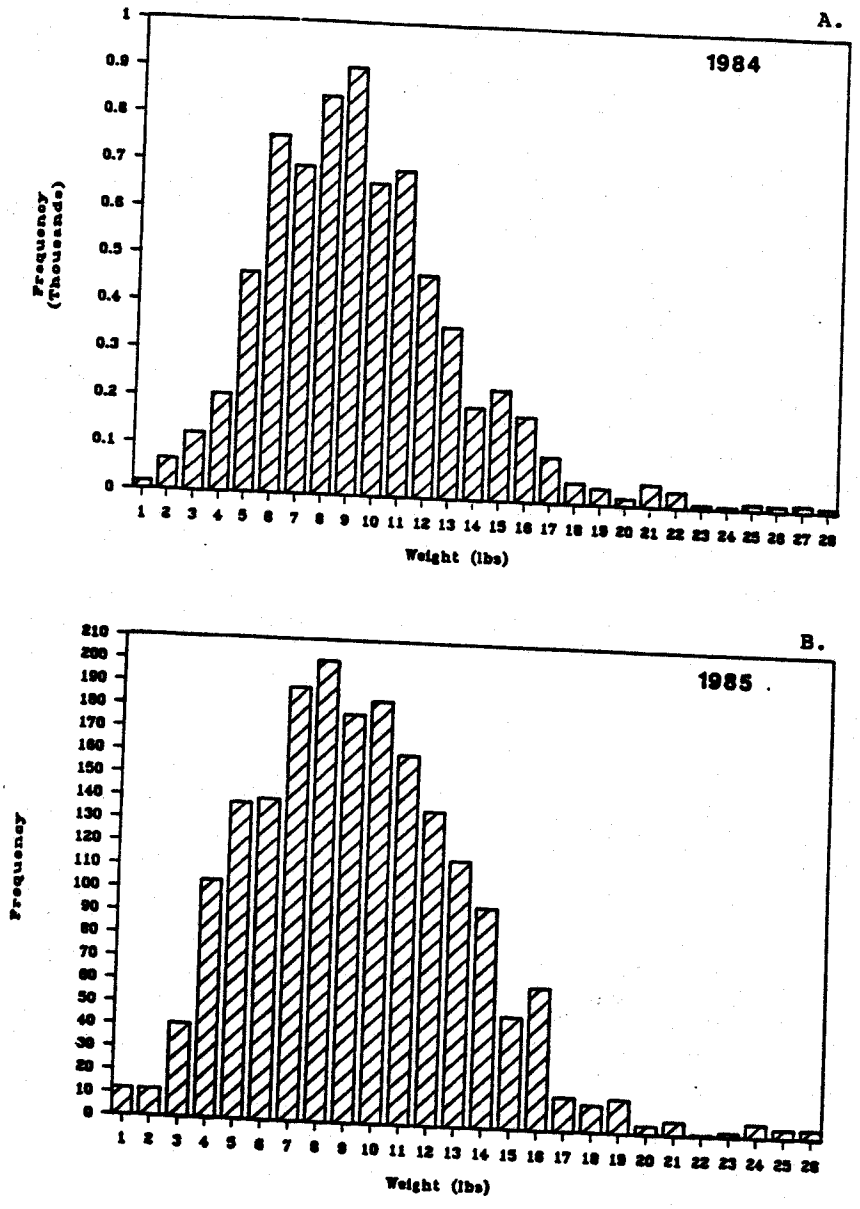
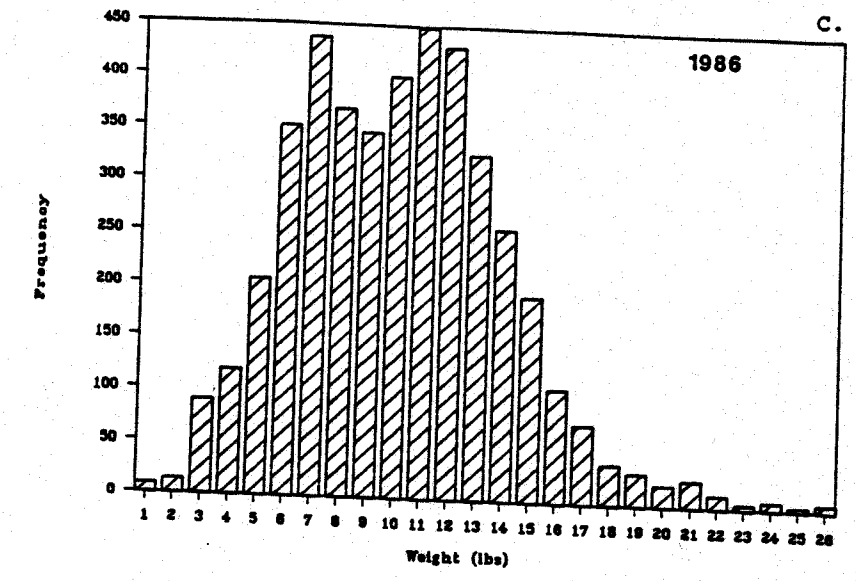


Figure 14.—Size structure of uku landed from the main Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.



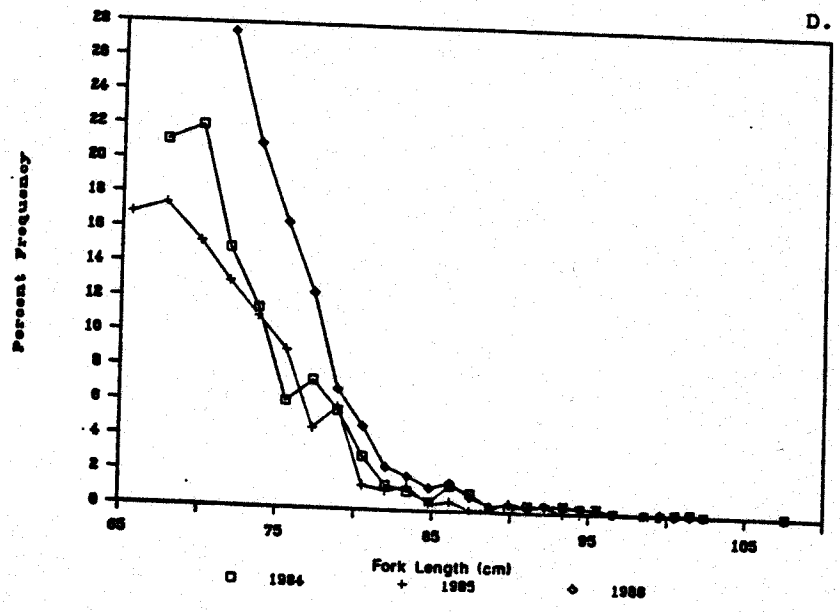


Figure 14.--Continued.

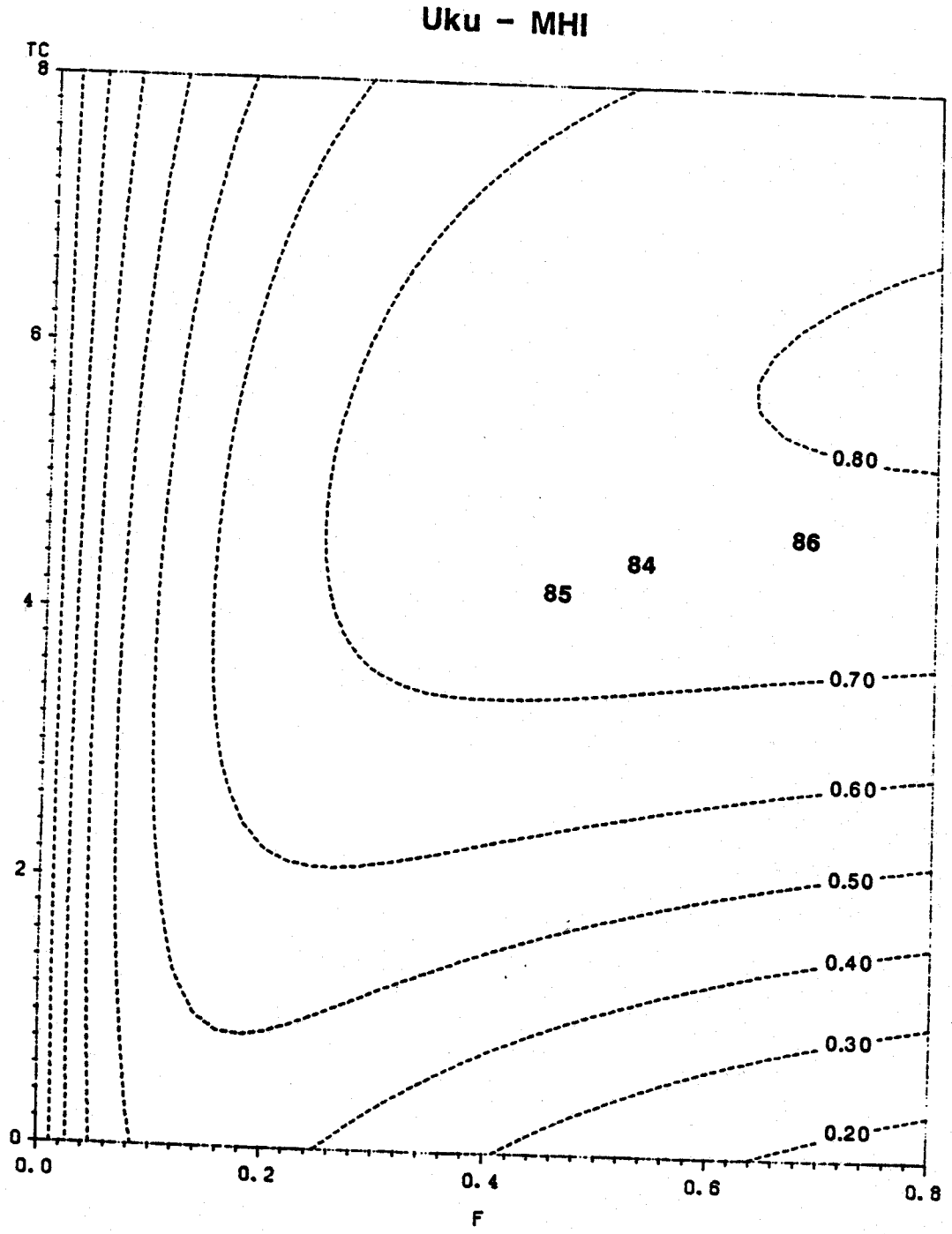


Figure 15.--Yield-per-recruit analysis for uku caught in the main Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

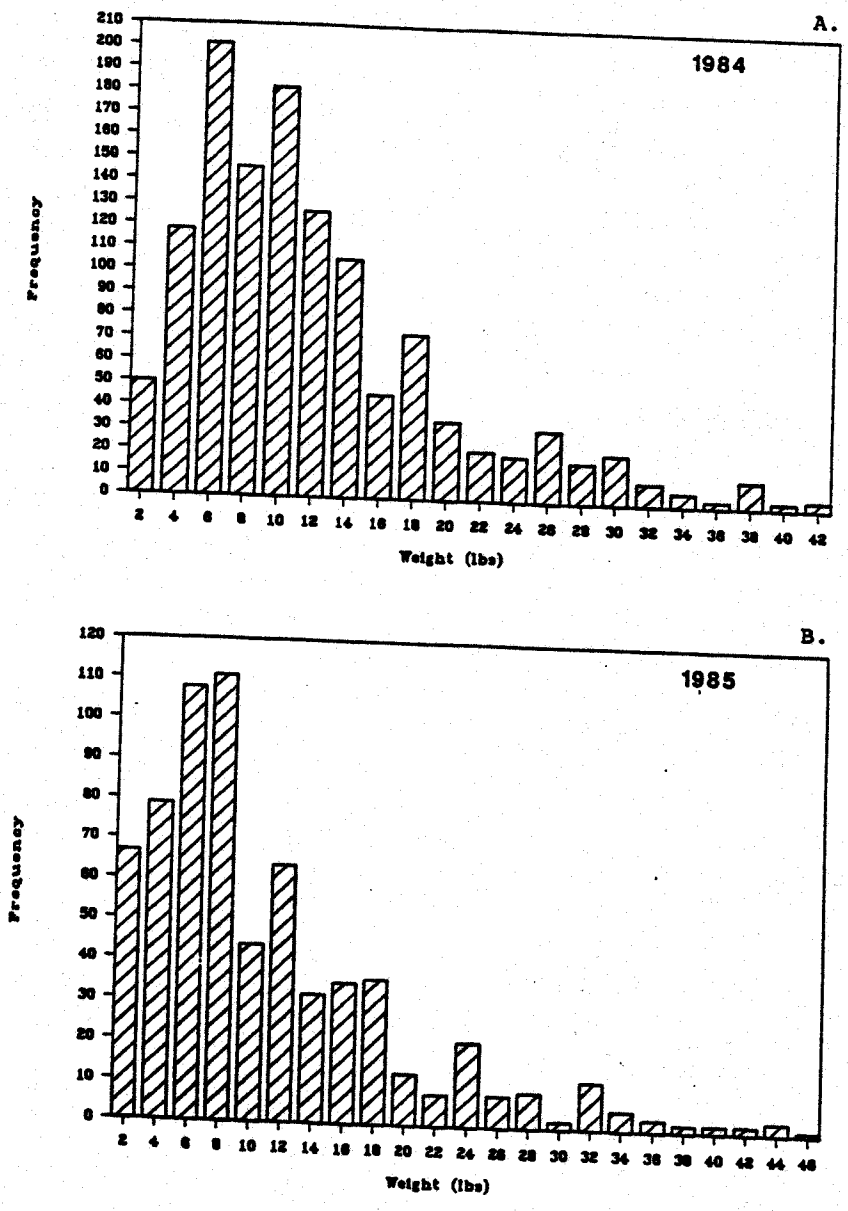


Figure 16.—Size structure of hapuupuu landed from the main Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.

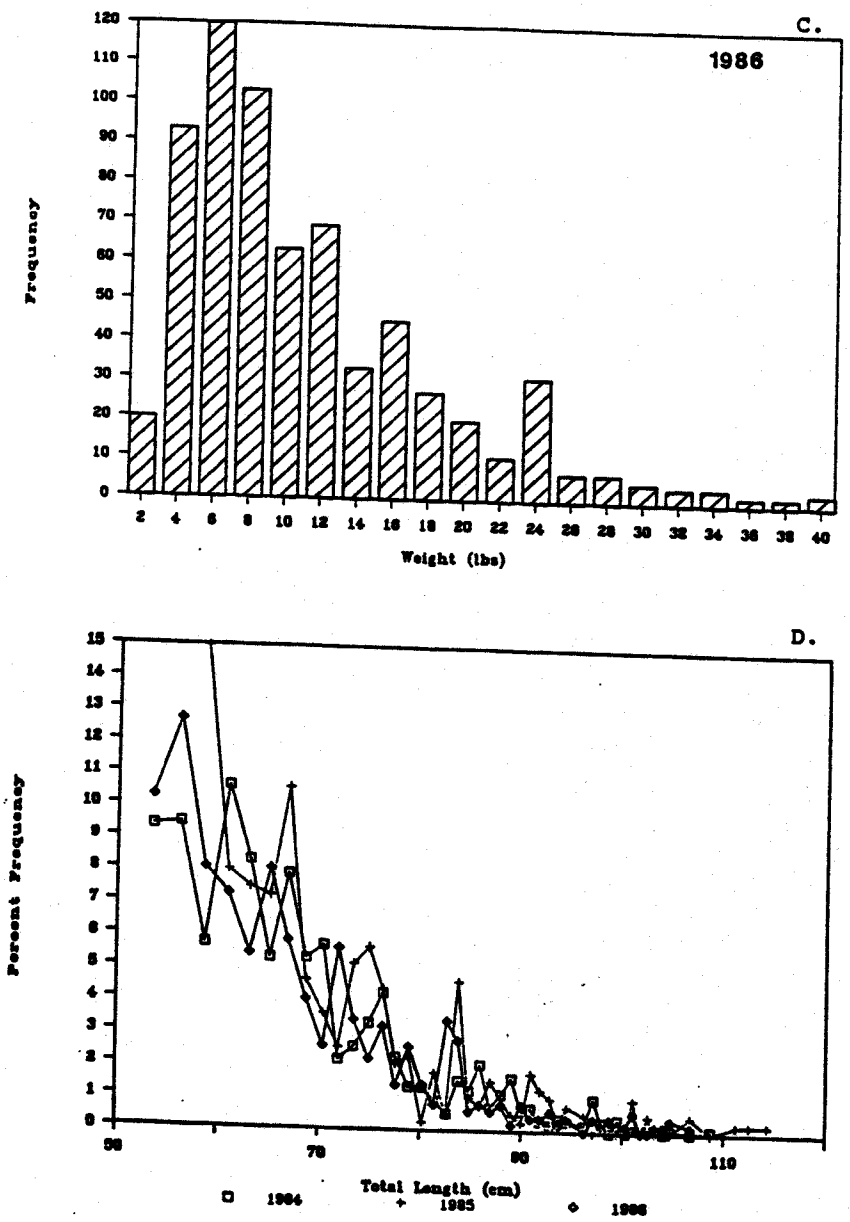


Figure 16.--Continued.

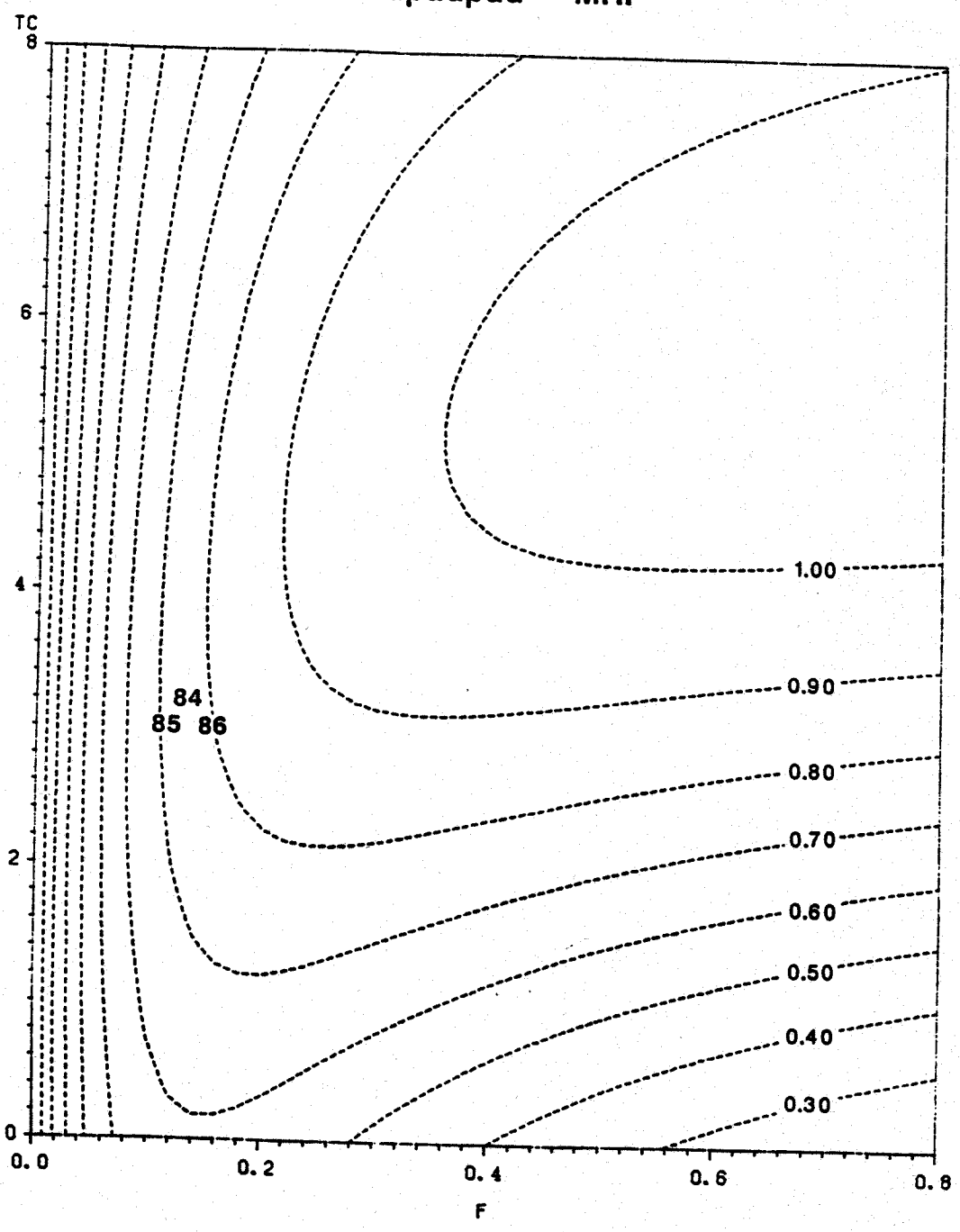


Figure 17.--Yield-per-recruit analysis for hapuupuu caught in the main Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

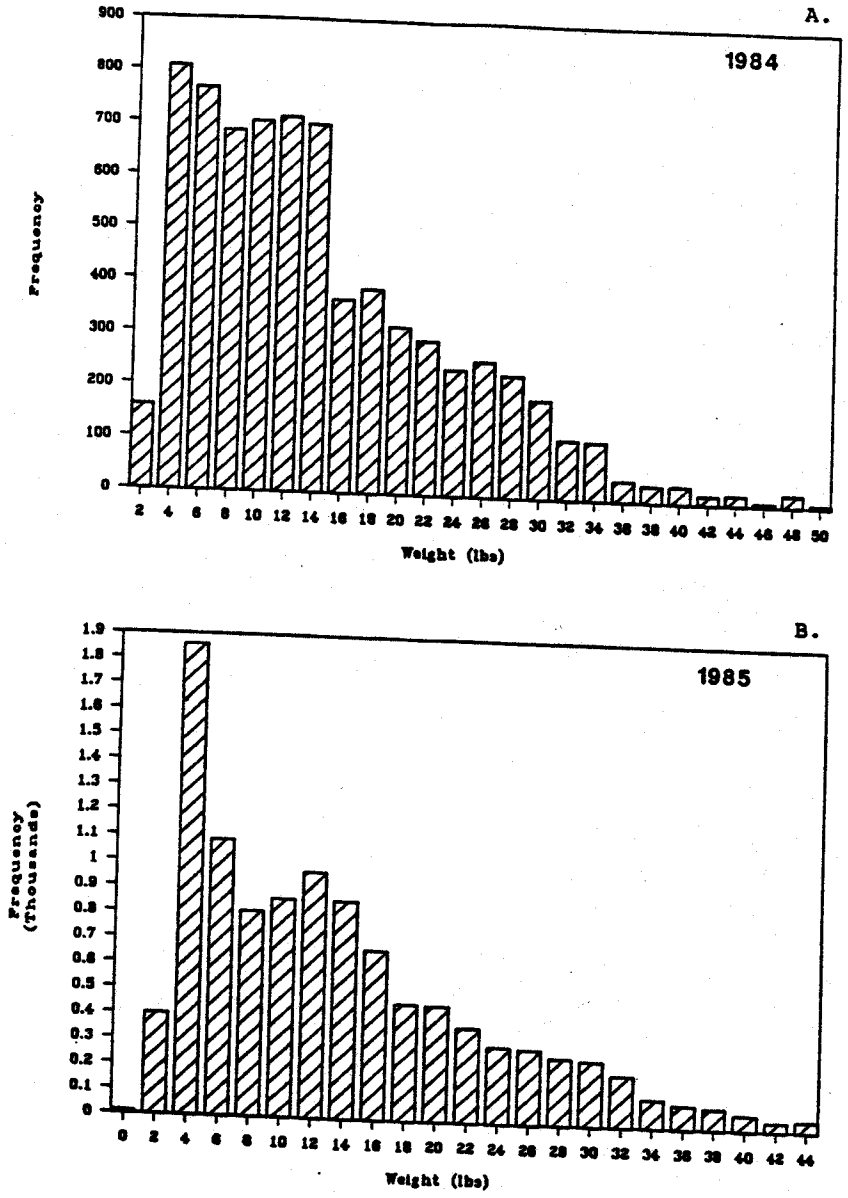


Figure 18.—Size structure of hapuupuu landed from the Northwestern Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.

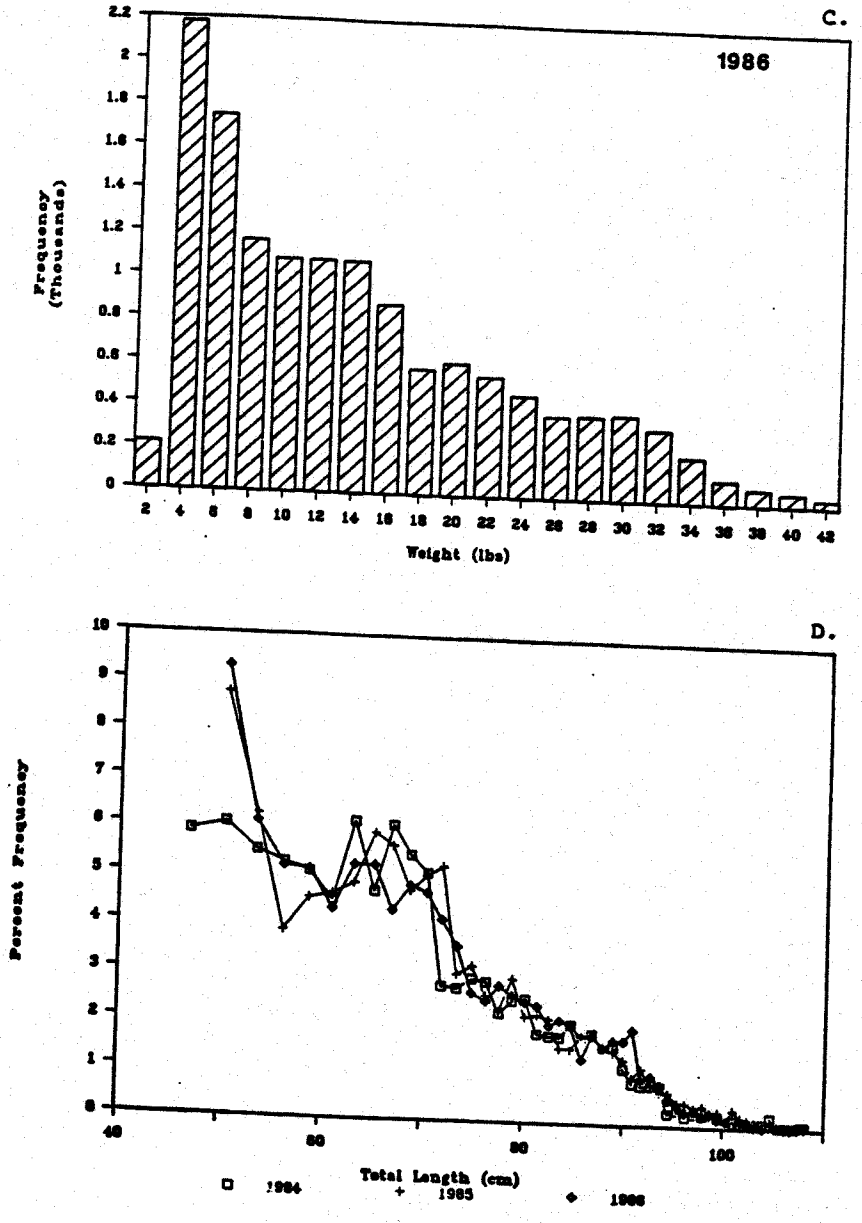


Figure 18.--Continued.

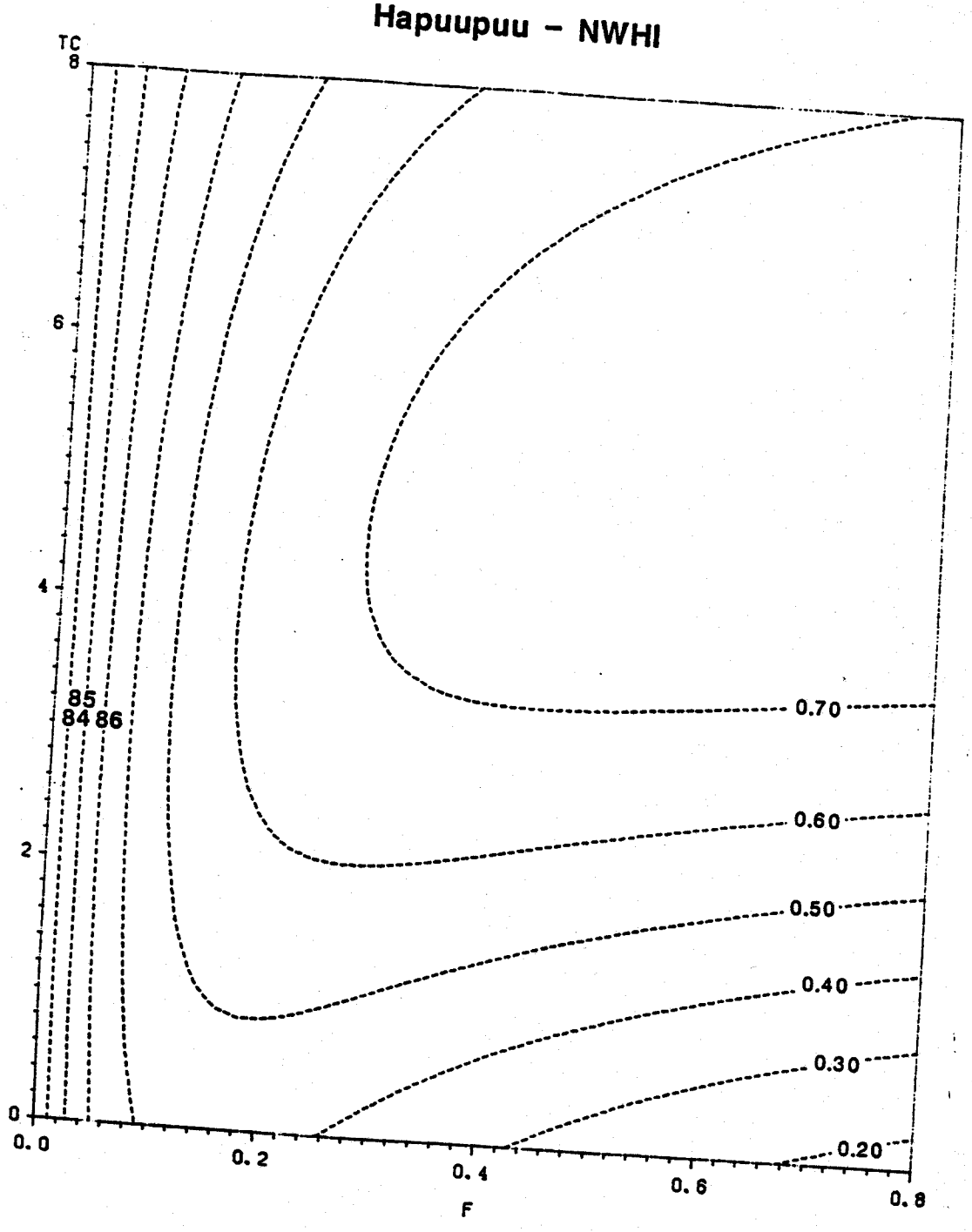


Figure 19.--Yield-per-recruit analysis for hapuupuuu caught in the Northwestern Hawaiian Islands. The unit of F is per year and the unit of t_c is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kg). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

and, without some compelling reason, it is unjustifiable to apply them to unrelated taxa. A preliminary analysis of size structure is possible, however, the results of which are presented in Table 4 and Figure 20.

Weight-frequency distributions for butaguchi landed from the NWHI are quite broad and flat (platykurtic). In such situations the detection of a mode becomes increasingly difficult and arbitrary. Still, as illustrated in the length-frequency polygons for this species (panel D), the descending limb for 1986 shows little curvature. Those for 1984 and 1985 appear to exhibit more severe levels of mortality. Like the NWHI harvest of opakapaka discussed above, this pattern is consistent with a change in the geographical pattern of fishing activity between these time periods.

Geographical Patterns of Fishing in the Northwestern Hawaiian Islands

Even though detailed information on the geographical origin of bottom fish landings did not become widely available until 1986, it is possible to examine the pattern of fishing activity in the NWHI with the existing data. Caution must be exercised, however, because only a small portion of the 1984 and 1985 NWHI bottom fish landings include bank specific fishing locations (15 and 8%, respectively).

The results presented in Figures 21 and 22 show how the geographical pattern of fishing in the NWHI has altered in the last 3 years. In Figure 21 the areal distribution of the opakapaka catch is shown in each year since 1984. Note that the fishing banks are listed horizontally and are arranged in rank order relative to distance up the archipelago. For example, Middle Bank (MD) is the closest to Honolulu, while Pearl and Hermes Reef (PH) is the most distant. The pattern is mimicked in Figure 22, in which the geographical pattern of total bottom fish landings is summarized.

The data presented in these figures strongly suggest that in 1984 and 1985 the center of bottom fishing activity in the NWHI was in the vicinity of Twin Banks, Necker Island, French Frigate Shoals, and Brooks Banks. In fact, the "expected" or average distance to the fishing grounds for a unit weight of opakapaka harvested in 1984 was 498 nmi from Honolulu (Brooks Banks). The comparable figure for 1985 was 411 nmi (Necker Island, French Frigate Shoals). Because of the sparse representation of bank specific information available for these 2 years, however, it is unlikely that this slight difference in the mean distance to the fishing grounds represents any sort of meaningful alteration in fishing activity.

In contrast, bottom fish fishing activity in 1986 had extended much farther up the Hawaiian chain. Significant landings of opakapaka and other bottom fishes were taken at Gardner Pinnacle, Raita Bank, Maro Reef, Laysan Island, Northampton Seamounts, Pioneer Bank, and especially Lisianski Island. The expected distance to the fishing grounds for a unit weight of opakapaka in 1986 was 771 nmi, equivalent to traveling as far as Maro Reef and Laysan Island.

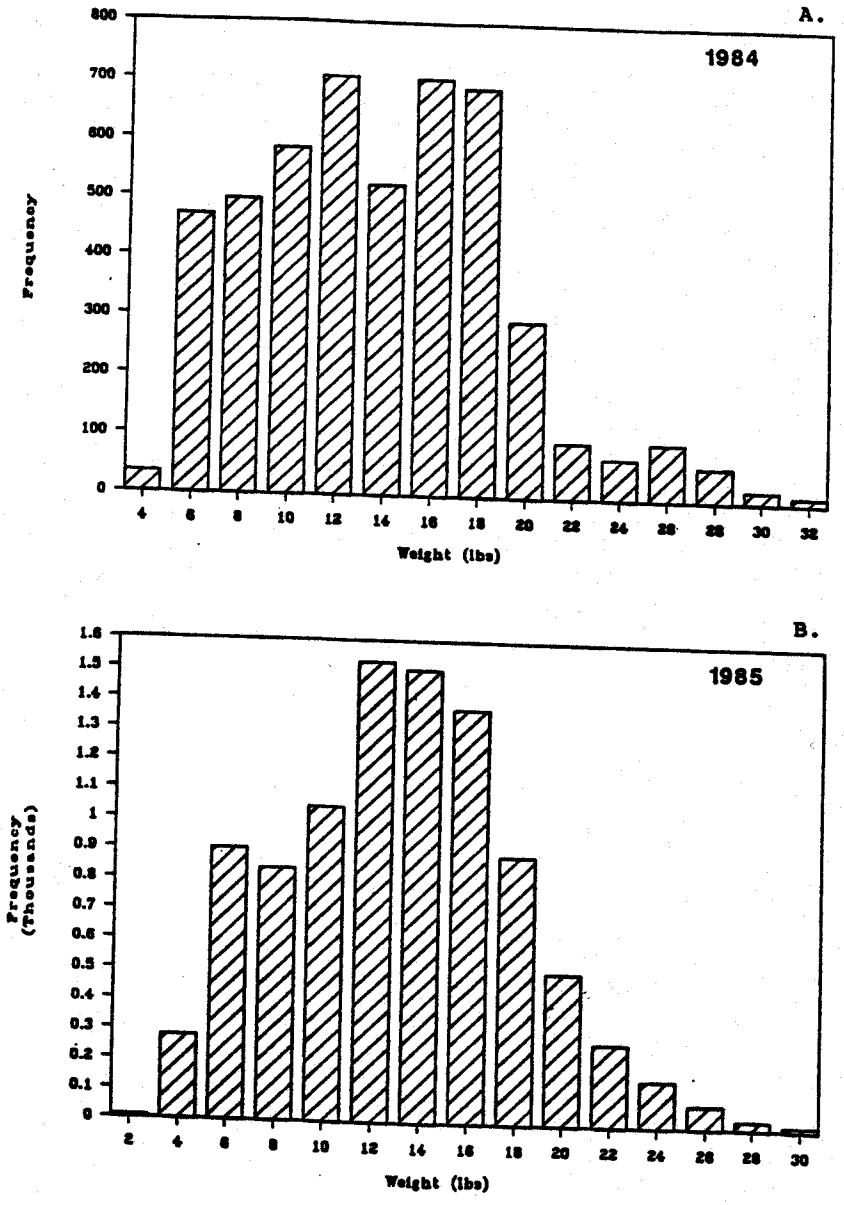


Figure 20.—Size structure of butaguchi landed from the Northwestern Hawaiian Islands over the period 1984-86. The first three panels (A-C) provide the weight-frequency histograms for each year. The fourth panel (D) is an overlay of the annual relative length-frequency polygons.

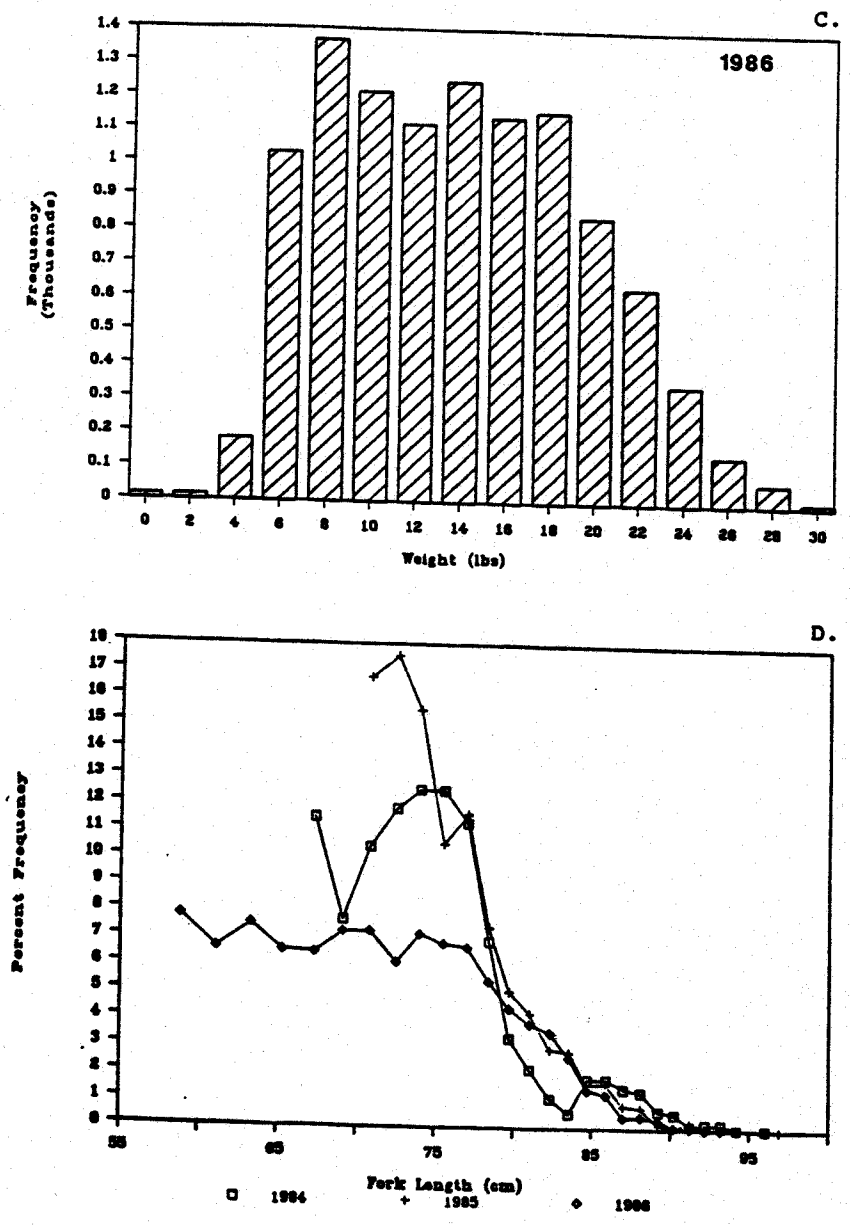


Figure 20.--Continued.

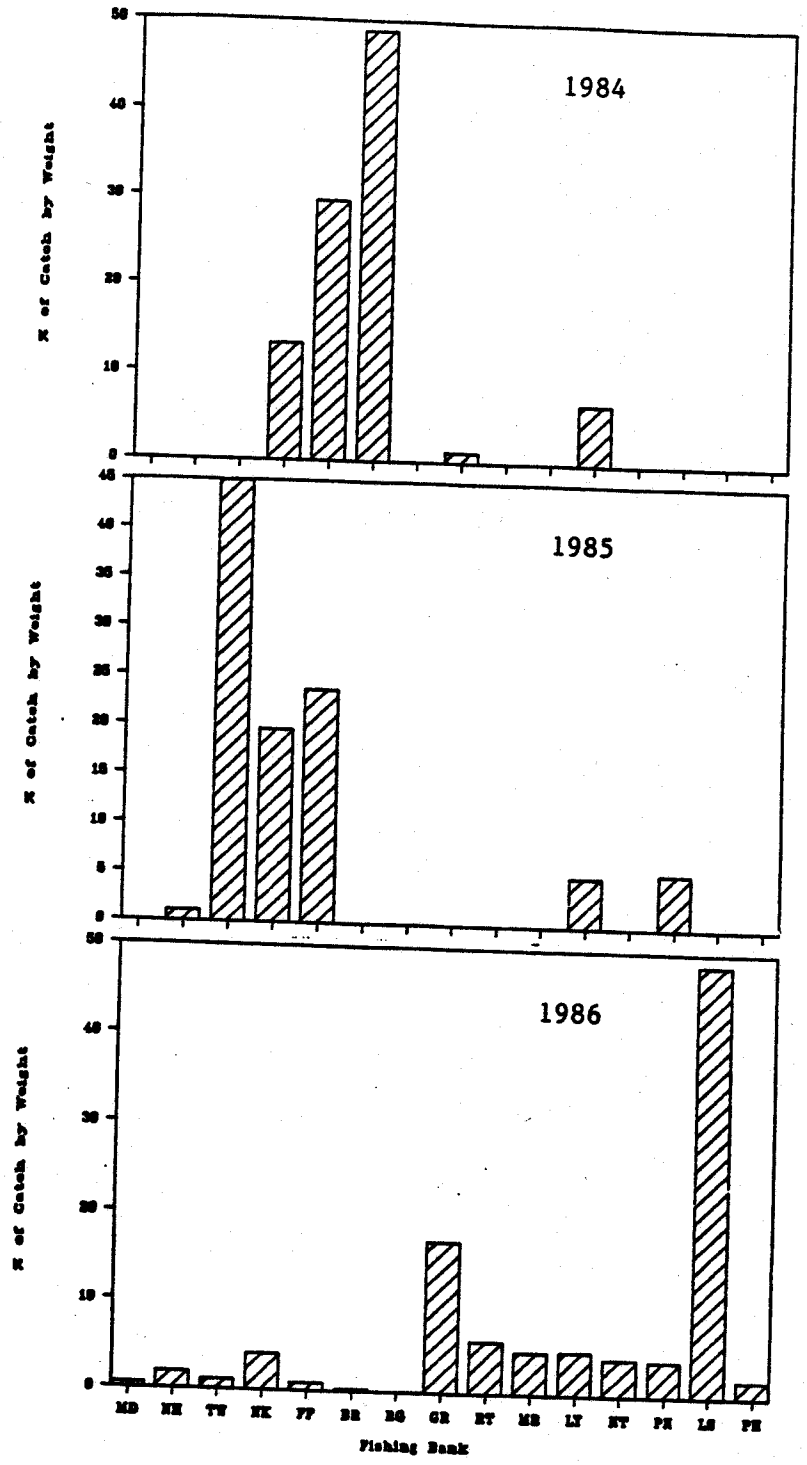


Figure 21.--Locations of opakapaka harvests in the Northwestern Hawaiian Islands (1984-86). Fishing bank abbreviations are as follows: MD = Middle Bank, NH = Nihoa, TW = Twin Banks, NK = Necker Island, FF = French Frigate Shoals, BR = Brooks Banks, RG = St. Rogatien Banks, GR = Gardner Pinnacles, RT = Raita Bank, MR = Maro Reef, LY = Laysan Island, NT = Northampton Seamounts, PN = Pioneer Bank, LS = Lisianski Island, PH = Pearl and Hermes Reef.

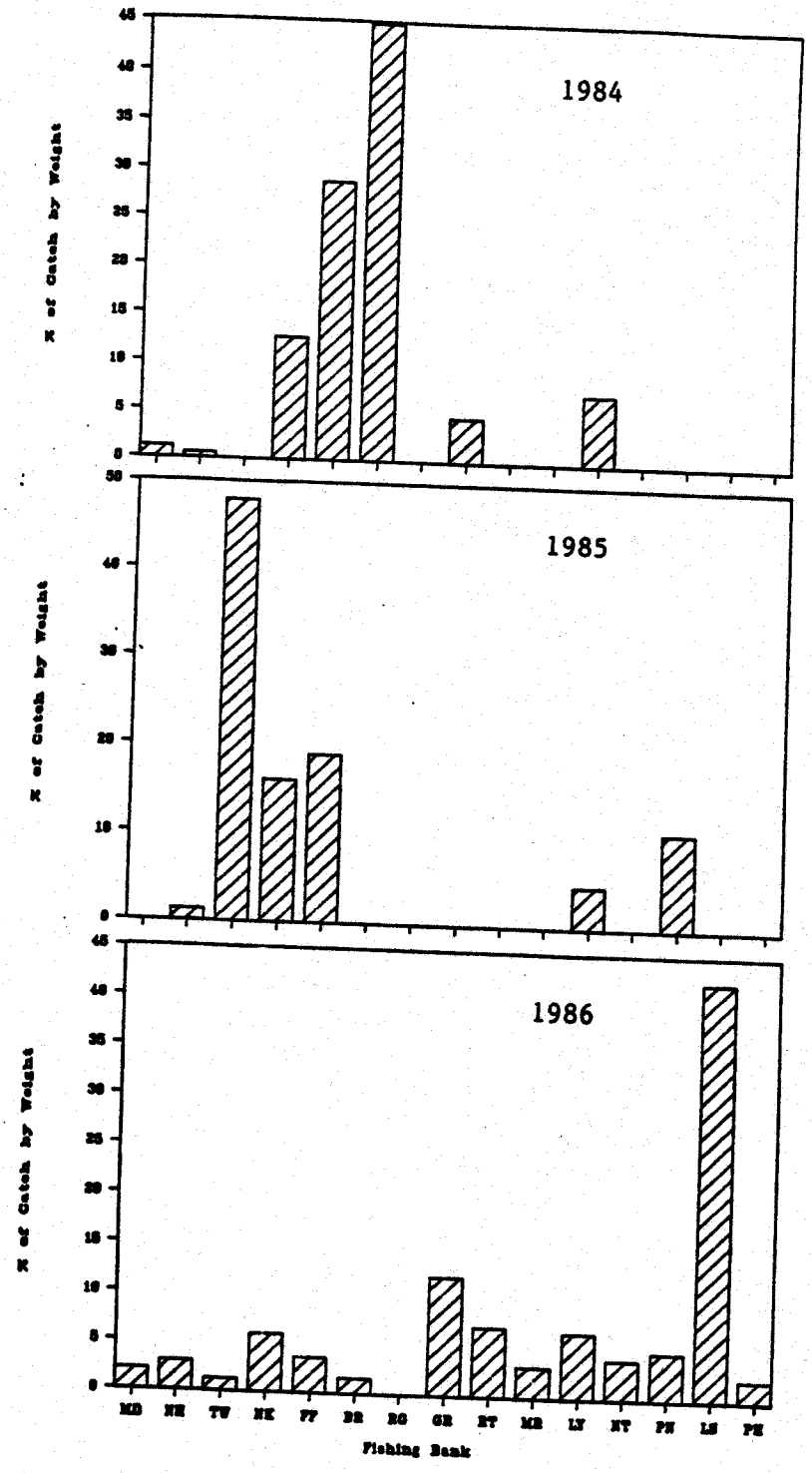


Figure 22.--Locations of bottom fish harvests in the Northwestern Hawaiian Islands (1984-86). Fishing bank abbreviations are as follows: MD = Middle Bank, NH = Nihoa, TW = Twin Banks, NK = Necker Island, FF = French Frigate Shoals, BR = Brooks Banks, RG = St. Rogatien Banks, GR = Gardner Pinnacles, RT = Raita Bank, MR = Maro Reef, LY = Laysan Island, NT = Northampton Seamounts, PN = Pioneer Bank, LS = Lisianski Island, PH = Pearl and Hermes Reef.

These results illustrate that the fishing activities of the bottom fishing fleet in the NWHI have been in a dynamic state of flux. Fishermen are traveling greater distances up the Hawaiian Island chain in order to encounter the higher catch rates that characterize unexploited fishing grounds. The move up the archipelago has occurred in conjunction with what has been an overall decline in the NWHI harvest of opakapaka, the previous mainstay of the fishery. Significantly, the natural abundance of opakapaka is known to decline with the distance traveled up the NWHI (Moffitt 1980; Humphreys 1986). The "fishing-up" process (sensu Ricker 1975) for this species in the NWHI is now likely complete.

Bottom Fishing Effort and CPUE in the Northwestern Hawaiian Islands

For the years 1984-86 there were 144, 164, and 166 recorded "bottom fishing trips" to the NWHI, respectively. Due to a small catch many of these represented an ineffective application of fishing effort, however. Thus, in order to qualify as an effective fishing trip (the nominal unit of fishing effort), at least 454 kg (1,000 lb) of bottom fish needed to be landed and marketed at the wholesale market. Under this constraint there were 108, 136, and 140 effective bottom fish fishing trips to the NWHI over the time period in question. Moreover, the mean catches (lb) of bottom fish per effective trip (CPUE) were 4,888, 5,332, and 5,539 during the 1984-86 period. From these data in isolation there is no indication of a decline in the abundance of bottom fish in the NWHI.

In order to more closely assess changes in NWHI bottom fish catch rates, the success of individual fishing vessels was followed over the last 3 years. The results presented in Table 5 document the annual CPUE statistics (mean pounds per effective fishing trip) for the 30 different vessels that actively participated in the fishery. In 1984 there were a total of 18 boats, in 1985 there were 21, and in 1986 there were 22 vessels contributing significantly to the fishery. Thus, the balance of entry to and exit from the fishery has resulted in a net gain in each year for which there are data. In terms of participants the fishery is growing.

Close examination of the data in Table 5 reveals 11 boats that fished all 3 years. Standardizing annual comparisons of CPUE by restricting the computation of sampling statistics to a uniform set of sampling units (i.e., vessels) should increase the power of the comparison to detect change. The mean catch rates of the 11 vessels that participated in the NWHI fishery during all 3 years for which there are data are 4,190, 4,230, and 4,866 lb per effective bottom fish fishing trip, respectively. Standard deviations about these means are 1,750, 1,827, and 1,886. These figures confirm the prior comparison based upon the entire fleet. Overall there has been no decline in the total bottom fish catch per NWHI fishing trip since 1984. If anything, there has been a slight increase.

Table 5.--Bottom fish CPUE in the Northwestern Hawaiian Islands. The catch rates (pounds per trip) of 30 different fishings vessels are listed for the years 1984-86. Note that 11 different vessels (H-R) fished in all 3 years.

Vessel		1984	1985	1986
1.	A	6,202	--	--
2.	B	2,554	--	--
3.	C	10,812	--	--
4.	D	2,905	--	--
5.	E	1,489	1,042	--
6.	F	1,391	2,130	--
7.	G	3,409	4,224	--
8.	H	4,585	3,040	5,100
9.	I	5,147	5,684	3,296
10.	J	4,743	3,630	3,526
11.	K	3,757	2,869	4,806
12.	L	3,175	4,354	4,091
13.	M	3,725	3,248	6,385
14.	N	2,229	5,959	5,653
15.	O	8,529	8,303	6,465
16.	P	4,143	4,398	4,402
17.	Q	1,922	1,744	1,368
18.	R	4,132	3,304	8,434
19.	S	--	2,397	1,466
20.	T	--	1,708	2,014
21.	U	--	7,242	7,706
22.	V	--	7,471	6,323
23.	W	--	8,994	11,328
24.	X	--	4,038	1,233
25.	Y	--	5,735	--
26.	Z	--	--	1,608
27.	AA	--	--	3,756
28.	BB	--	--	6,893
29.	CC	--	--	1,225
30.	DD	--	--	11,457

DISCUSSION

In attempting to synthesize the information presented here it is useful to review and reiterate the key assumptions of the analysis, of which there are five.

The first assumption is that the size structure of the bottom fish catch is adequately represented by the methods discussed in Ralston, Tagami, and Shiota (1986). Depending on the species they showed that 88.0–96.5% of all variation in bottom fish weights is attributable to differences between lots. Therefore, by calculating the mean weights of fish in auction lots, it is possible to generate a size-frequency distribution by allocating fish to the size class of their lot mean (Ralston and Kawamoto 1985). A refinement is to estimate the weight variance within lots as a function of the species, lot weight, and number of fish (Ralston, Tagami, and Shiota 1986). Fish are then allocated to size categories in accordance with lot means and variances under the normal distribution. This procedure accounts for 97.2–99.3% of the total variation in bottom fish weight. In this study allocation was made solely according to lot means. It was found that the estimation of L_∞ using the method of Wetherall et al. (in press) was sensitive to the largest size class represented in a length-frequency distribution. Mortality estimates were in turn very sensitive to values of L_∞. Because weight variance increases with a lot's weight and the number of fish comprising it, the process of allocation using both the mean and variance caused the presumptive assignment of fish to large weight categories, a result that could not be confirmed empirically. Allocation using only the mean weights is by comparison a more conservative approach to estimating L_∞. Still, the important point is that the weight distributions of the species studied here were estimated, undoubtedly with some error.

An even more important assumption is that the weight distributions derived from the catch (i.e., lot statistics) can be used as valid samples to infer something about the size structure of bottom fish populations in the wild. While evidence exists to show that hooks are capable of catching fish over a very broad range in size and that size structure is quite insensitive to alterations in gear (suggestive of constant selectivity) there are no data available to show that attack rates are independent of fish size. Intra-specific and behavioral interactions could alter the size composition of catch samples in ways we only partially understand (Allen 1963; Bannerot and Austin 1983). The interpretation of the descending limbs of length-frequency distributions relies critically on the assumption that catch samples are representative of the stock.

A third assumption is that snapper and grouper growth coefficients and natural mortality rates can be estimated with the comparative method. The graphs and equations presented in Manooch (1987) and Ralston (1987) permit the statistical prediction of "average" snapper and grouper vital rates from estimates of maximum size, but the extent to which the species studied here conform to such average expectations is unknown. However, at least one Hawaiian species (opakapaka) has been studied in some detail (Ralston and Miyamoto 1983; Ralston 1984). For this species the predictive estimates of vital rates are very similar to those determined by direct study.

An additional analytical simplification is that the Beverton and Holt (1956) length-based mortality estimator assumes that recruitment to the exploitable phase occurs at a constant uniform rate, and yet the spawning and recruitment of Hawaiian fishes is known to be seasonal (Walsh in press). Moreover, the length-frequency samples analyzed here represent an annual accumulation of fish in the catch. Ralston (in prep.) has shown, however, that the use of the Z/K length-based estimator is justified under such conditions. Pooling data from throughout the year results in an integrated average of stock size structure and obviates the bias due to seasonal recruitment.

Several important final assumptions are inherent in the formulation of the Beverton and Holt (1957) yield equation and underly the computation of yield per recruit. For one, this particular model assumes that recruitment to the exploitable phase is independent of stock size and fishing pressure. Over a fair range of stock conditions this assumption has been shown to be more or less realistic (Cushing 1973). Nevertheless, the subject of recruitment-overfishing is something that has not been seriously considered in this assessment. This topic deserves to be reviewed at some time in the future.

Moreover, application of the Beverton and Holt (1957) yield-per-recruit model presupposes that it is desirable to optimize the yield in biomass from a fish stock. Sometimes this may not be the case if, as a result of market conditions, a premium is placed on small fish. This may well be the case in the MHI fishery for ehu. It is possible to perform an assessment in which factors other than yield are optimized, although this has not been attempted here.

Lastly, the Beverton and Holt model is constructed under equilibrium conditions. Actually, there are several aspects of the present study in which this particular assumption is violated. The first relates to the computation of mortality rates from length-frequency distributions. As indicated previously, calculating vital rates based on length or age-frequency distributions from catch statistics provides a glimpse of historical conditions in the fishery (Ricker 1975). When these are altered through time, changes in size structure lag behind. Estimates of mortality derived here are, therefore, likely to be somewhat in error. Secondly, the actual composition of bottom fish populations under exploitation is in a state of flux. Strong evidence exists to show that the NWHI fleet has recently made significant changes in fishing grounds (Figs. 21 and 22). Thus, the fishery is not in equilibrium in time or space.

Given these principal assumptions, with their associated caveats, it is possible to draw several conclusions concerning the status of bottom fish stocks in the Hawaiian Islands.

The assessment in the MHI is generally consistent. Conditions seem to have been stable over the 1984-86 time period, as indicated by the uniformity in landing statistics (Table 3). There is evidence of growth-overfishing for three of the five species studied (opakapaka, ehu, and uku). An increase in the age at entry to the fishery would benefit all three

species. Minimum size limits would therefore seem warranted, especially for opakapaka. The harvest of 1 and 2 lb pound individuals is a biological waste in the short run and over the long term it could ultimately affect the ability of the stock to replenish itself. Although there are certain costs in implementing minimum size regulations, including those due to the mortality of released fish and the transition losses incurred in moving from one equilibrium state to another (Huntsman and Waters 1987), they only become more severe as growth-overfishing continues unabated.

Even though there is evidence of overfishing in the MHI for three of the most important species of bottom fish, the condition of hapuupuu and onaga stocks would seem to be much better. The assessment for onaga, in particular, is surprising. As indicated in Table 3, MHI catch totals for this species are substantial. Moreover, the length-frequency polygons of panel D in Figure 6 show that a broad size range of fish are entering the marketplace. Relatively speaking, large onaga are plentiful in the MHI. There is thus some justification for encouraging further exploitation of this resource.

With respect to the best available information concerning MSY, it is difficult to evaluate the MHI fishery for bottom fish. A figure of 285 t of sustainable yield has been given for this fishery. In 1986 landings at the wholesale market were about 130 t. The difficulty here is that there exists a harvest of fish that does not appear at the wholesale market, which is presently unaccounted for. Recreational fishing and sales of MHI fish through other market channels are believed equal in magnitude to the wholesale share of the fishery. Although more data are needed before a proper assessment relative to MSY can be made, the harvest of bottom fish in the MHI is probably close to MSY, if not in excess of it.

The situation in the NWHI is more complex. Opakapaka landings are in a state of decline as vessels fish farther up the archipelago in search of productive fishing grounds. The fishery is presently in a state of disequilibrium, a problem exacerbated by inadequate data on fishing locations in 1984 and 1985.

The yield-per-recruit analysis for NWHI opakapaka indicated that fishing mortality is actually declining. Bottom fish effort statistics indicate otherwise. The number of effective vessel trips has increased from 108 to 140 in 3 years, a 30% increase. The likely explanation for the apparent decrease in opakapaka fishing mortality rate is that the fleet has moved to the northwest and cropped the final vestiges of opakapaka populations in the NWHI. Henceforth the fishery for this species will likely be based on catch rates characteristic of a stock under moderate exploitation.

As fishing pressure in the farther reaches of the NWHI has increased landings of other, less desirable, species have risen. The catch of hapuupuu and butaguchi in the NWHI has doubled since 1984. The natural abundance of these species to the northwest of Raita Bank does not decline in parallel with opakapaka (Moffitt 1980). Given the extensive fishing activity in the vicinity of Northampton Seamounts and Lisianski Island in 1986, an increasing share of these species in the catch is thus to be

expected. Since new fishing grounds have been exploited this would explain the relatively low estimates of fishing mortality derived for the hapuupuu.

All evidence indicates that the onaga is starting to replace the opakapaka in the catch of NWHI bottom fishermen. Both are highly priced species that could support a fishery. Moreover, the yield-per-recruit analysis of NWHI onaga provided some justification for expanding fishing effort. An obstacle to the development of this fishery, however, is the shorter shelf life of onaga in comparison with opakapaka, a constraint that reduces the length of time vessels can stay on the fishing grounds.

In 1986 overall landings of bottom fish from the NWHI exceeded the best available estimate of MSY by 18%. In and of itself, this is not cause for alarm because the fishery is in a state of disequilibrium. The record harvest of 1986 is likely due in large part to the fishing-up of stocks as the fleet moved farther to the northwest. Nevertheless, there is every reason to be concerned about the biological condition of bottom fish stocks in the NWHI. With fishing activity so unstable the estimation and interpretation of vital rates from catch composition is severely compromised. One major improvement in our ability to monitor conditions within the fishery is the precise (i.e., bank specific) recording of fishing location. Without this type of data future assessments will be very much in jeopardy.

ACKNOWLEDGMENTS

We would like to thank Paul Gates of the Western Pacific Regional Fishery Management Council for suggesting the analysis of geographical patterns of fishing in the NWHI. Moreover, without the helpful cooperation of the United Fishing Agency this study would not have been possible. Appreciation is also extended to the skippers and owners of the fishing vessels that operate in the NWHI and all of the wholesalers who attend the fish auction daily. Occasionally Skippy Hau, Joanne Ho, and Jason Fukumoto helped collect the data. Special thanks to all three.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731-7415

March 9, 1988 F/SWR1:ETN

Ms. Kitty Simonds
Executive Director
Western Pacific Regional Fishery
Management Council
1164 Bishop Street, Suite 1405
Honolulu, HI 96813

Dear Kitty:

This is in response to your letter regarding Section 7 consultation for implementation of Amendment 2 to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (Bottomfish FMP). The Amendment is specific to the EEZ of the Northwestern Hawaiian Islands (NWHI) and is intended to diminish the risk of overfishing.

As described in the proposal the Amendment will reduce the number of vessels engaged in the fishery thereby lessening risk of negative interactions with listed species. The proposed Amendment will not cause or result in the adverse modification of the habitat of any threatened or endangered species in the NWHI. The inclusion of Section 3.11, Workshop on Endangered and Threatened Species Concerns requires all permitted fishermen to attend an information workshop regarding protected species.

Our review of Amendment 2 finds that its implementation will not likely adversely affect listed species and will not substantively alter the conclusions in the Biological Opinion issued by the NMFS for the Bottomfish FMP on February 10, 1986. Accordingly, neither formal consultation nor reinitiation of consultation under Section 7 of the Endangered Species Act of 1973, as amended, will be required for this action. However, informal consultation should continue as the Amendment is implemented. The principal contact for this consultation is Eugene T. Nitta, Protected Species Coordinator, Western Pacific Program Office, Southwest Region. Should you require any further information he can be reached at 808/955-8831.

Sincerely yours,

E C Fullerton
E.C. Fullerton
Regional Director

cc: F/SWR1

U.S. Department of Transportation
United States Coast Guard

Commander (ole)
Fourteenth Coast Guard District

Prince Kalanianaole
Federal Building
300 Ala Moana Blvd.
Honolulu, Hawaii 96850
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Mr. John Sproul
Western Pacific Fishery
Management Council
1164 Bishop St. - Room 1405
Honolulu, Hawaii 96613

Dear Mr. Sproul:

You have requested Coast Guard input on Amendment #2 to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. Specifically, you have requested a written evaluation on the effects on safety of Amendment #2.

Section 303(a) of the Magnuson Fishery Management and Conservation Act (MFCMA), as amended on 14 November 1986, provides, among other things:

> ... any fishery management plan which is prepared by any Council...with respect to any fishery shall...consider, and may provide for, temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels.....16 U.S.C. 1853(a) (as amended by Pub. L. No. 99-659, Sec 105(a)(1)(c)).

Amendment #2 does not call for temporary adjustments, such as altering a closure schedule, to accommodate fishing vessels prevented from harvesting by weather or other ocean conditions affecting vessel safety. Consequently, there is no issue in this amendment to be addressed by the Coast Guard within the statutory guidelines of the MFCMA.

Please feel free to contact me concerning any additional inquiries you may have.

Sincerely,

M.J. Williams, Jr.
M.J. WILLIAMS, JR.
Commander, U. S. Coast Guard
Chief, Law Enforcement Branch
By direction of the District Commander